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DISTRIBUTION, ABUNDANCE AND HABITAT UTILIZATION OF SPORT FISHES DOWNSTREAM OF THE OLDMAN RIVER DAMSITE LATE WINTER AND SPRING, 1986

ENVIRONMENTAL MANAGEMENT ASSOCIATES

DISTRIBUTION, ABUNDANCE AND HABITAT UTILIZATION OF SPORT FISHES DOWNSTREAM OF THE OLDMAN RIVER DAMSITE LATE WINTER AND SPRING, 1986

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1.0 EXECUTIVE SUMMARY

The Government of Alberta will construct a dam on the Oldman River for the purpose of providing a dependable, multi-purpose water supply that would also permit substantial expansion of irrigation in southern Alberta. Downstream of the reservoir one of the primary water demands will be maintenance of suitable flows for fish habitat. The Planning Division of Alberta Environment commenced field investigations of rainbow trout spawning activities downstream of the damsite in the spring of 1985 (IEC Beak Consultants Ltd. 1985), and contracted studies to identify summer and fall fisheries habitat utilization as well as the instream flow needs of the sport-fish fauna during the summer and fall seasons downstream of the damsite (Fernet and Matkowski 1986). These studies were complemented by the winter and spring fisheries investigations summarized below which were conducted during February, March and April of 1986.

The winter fisheries survey in the Oldman River downstream of the damsite was designed to provide quantitative information on species composition, distribution, relative abundance and habitat utilization of overwintering species of sport fish. Fisheries sampling and habitat assessment was conducted between the damsite and the confluence with the Belly River from 28 February to 16 March, 1986. Sudden heavy snowfall and melt immediately prior to field studies removed ice cover and produced greater than normal flows in the river during the study period.

Mountain whitefish and rainbow trout were the primary sport species within the study area. Mountain whitefish utilized the entire study area during the sampling period. Adults were most abundant upstream of the Lethbridge Northern Irrigation District weir (LNID) and occupied riffle, run and pool habitats. Juveniles were abundant upstream of LNID as well as downstream to Rocky Coulee (Segment 4), and also occupied riffles, runs and pools. Adult and juvenile mountain whitefish utilized runs and pools most frequently in areas upstream of LNID; downstream of LNID pools were rarely used and riffles were of greater importance. Few mountain whitefish fry were captured, likely because most sampling was conducted by boat electrofishing in habitat unsuitable for use by this life stage.

Adult and juvenile rainbow trout utilized the study area during the winter sampling period and were most common upstream of LNID. Adults occupied habitat in riffles, runs and pools. There appeared to be more adults present in winter than during the previous fall (Fernet and Matkowski 1986), perhaps because of downstream migration to overwintering areas by fish previously upstream of the damsite. Although juvenile rainbow trout were not uncommon, too few were captured in Habitat Areas measured to determine whether they preferred riffles, runs or pools.

Because habitat conditions in the Oldman River were atypical during the study, it is possible that the fish distribution and habitat utilization recorded were not representative of normal winter conditions.

Spring fisheries studies in the Oldman River downstream of the proposed damsite were designed to provide quantitative information on composition, distribution, relative abundance and habitat utilization of the sport fish species, and to assess rainbow trout spring migration and spawning activities. Studies were conducted between the proposed damsite and the Highway 2 bridge crossing of the Oldman River from 7 to 12 April and 22 to 24 April, 1986.

Mountain whitefish were the primary sport species found in the study area in spring. Adults and juveniles were only abundant upstream of LNID (Segments 5 and 6). Few mountain whitefish fry were captured, likely because sampling was conducted by boat electrofishing in habitat unsuitable for use by fry.

Rainbow trout were most common upstream of LNID. Adults were captured only upstream of LNID and were notably less abundant than in winter. Juveniles were captured throughout the study area. Abundance of juveniles appeared to decrease in Segment 5 and increase in Segment 6 when compared to the results of sampling conducted in February and March. Changes in adult and juvenile distribution from winter to spring likely indicate an upstream migration of adults to spawning areas above the Oldman River damsite, and an upstream movement by juveniles to summer rearing areas. No evidence of rainbow trout spawning activity was found in the study area.

2.0 INTRODUCTION

The Government of Alberta will construct a dam on the Oldman River for the purpose of providing a dependable, multi-purpose water supply that would also permit substantial expansion of irrigation in southern Alberta. One of the primary water demands downstream of the reservoir will be maintenance of suitable flows to provide fish habitat.

The Planning Division of Alberta Environment commenced fisheries investigations of the Oldman River downstream of the proposed damsite in 1985 (IEC Beak Consultants Ltd. 1985; Fernet and Matkowski 1986), and retained Environmental Management Associates (EMA) to conduct winter and spring fisheries surveys in the Oldman River during 1986. The winter study area was located between the proposed damsite and the confluence with the Belly River, while the spring study included the area between the proposed damsite and the Highway 2 bridge crossing of the river. The studies were designed to provide quantitative information on species compositions, distributions, relative abundance, and habitat utilization of sport fishes in winter and spring seasons. The spring study included documentation of the extent of rainbow trout migration and spawning activity in the study area.

3.0 SCOPE AND APPROACH

An initial overview report was prepared which compiled the existing fisheries information for the Oldman River between the headwaters and Fort Macleod, as well as the lower reaches of the Castle and Crowsnest rivers (Allan 1985). In addition to summarizing existing information, specific deficiencies were identified in the data base which precluded an assessment of the project, and the development of suitable mitigation measures for potential negative impacts. One of the data deficiencies involved a definition of the instream flow needs of the fish fauna between the proposed damsite and the Little Bow River confluence. To meet this data deficiency, Alberta Environment retained Environmental Management Associates to conduct a study of the fish distribution, abundance, critical habitats and relationships with stream flow downstream of the Oldman River damsite. This study was conducted during the summer and fall of 1985 (Fernet and Matkowski 1986).

To further meet data deficiencies, Alberta Environment retained EMA to conduct studies of the Oldman River fish fauna during the winter of 1985/86 and spring of 1986. The Terms of Reference for the winter study were as follows:

1) Determine the species composition, distributions, relative abundance, and habitat utilization of overwintering sport fish in the Oldman River mainstem from the proposed dam site downstream to the Belly River confluence.

2) Sampling sites will include habitat types representative of the four river segments that occur within the present study area delineated in the previous IFN fisheries study, as well as unique habitat types identified as potential overwintering habitat.

3) Captured fish will be identified to species, and sport fish tagged with an Alberta Environment reward tag prior to release. Depending on field conditions and numbers encountered, fish will

be either measured to fork length or subjectively classified to life stage (adult, juvenile, young-of-the-year).

4) Measurements of important habitat parameters will be collected at sites containing significant numbers of sport fish. These parameters will include depth, mean velocity, substrate and cover.

The winter study was conducted downstream of the damsite to the confluence with the Belly River (Figure 1) from 28 February to 16 March, 1986. The investigation was designed to determine the species composition, distributions, relative abundance and habitat utilization of overwintering sport-fish species. Sampling sites included habitat types representative of the four river segments (3, 4, 5 and 6) that occur within the present study area, as delineated in the previous instream flow needs (IFN) fisheries study (Table 1, Figure 2), as well as unique habitat types identified as potential overwintering habitat.

The approach taken to carry out the study was in part dictated by the physical state of the river. Prior to the commencement of field studies ice-cover on the Oldman River was removed by flood waters caused by the sudden melt of heavy snowfall. High discharges similar to those experienced during freshet precluded data collection for several days. Since the entire study area was ice free, fish location and collection was achieved primarily by boat electrofishing. Captured fish were analysed according to species and condition, and whenever possible tagged with an Alberta Environment reward tag prior to release. As well, two large rainbow trout were outfitted with Alberta Environment radio transmitters to assist in monitoring spring movements of these individuals in the river. Measurements of habitat characteristics at sites where significant numbers of sport fish were captured were also conducted at the prevailing open-water conditions. Parameters measured included area, depth, velocity, substrate and cover.

The Terms of Reference for the spring study were as follows:

Figure 1.
Location of Study Area.

TABLE 1

SEGMENT BOUNDARIES AND LENGTHS IN THE OLDMAN RIVER STUDY AREA

River Segment	Segment Boundaries		Segment Length (km)
	Downstream	Upstream	
3	Belly River	Rocky Coulee	24.2
4	Rocky Coulee	LNID Headworks	55.3
5	LNID Headworks	2 km upstream of Highway 785 (Summerview) Bridge	32.6
6	2 km upstream of Highway 785 (Summerview) Bridge	Damsite	5.4
Total			218.5

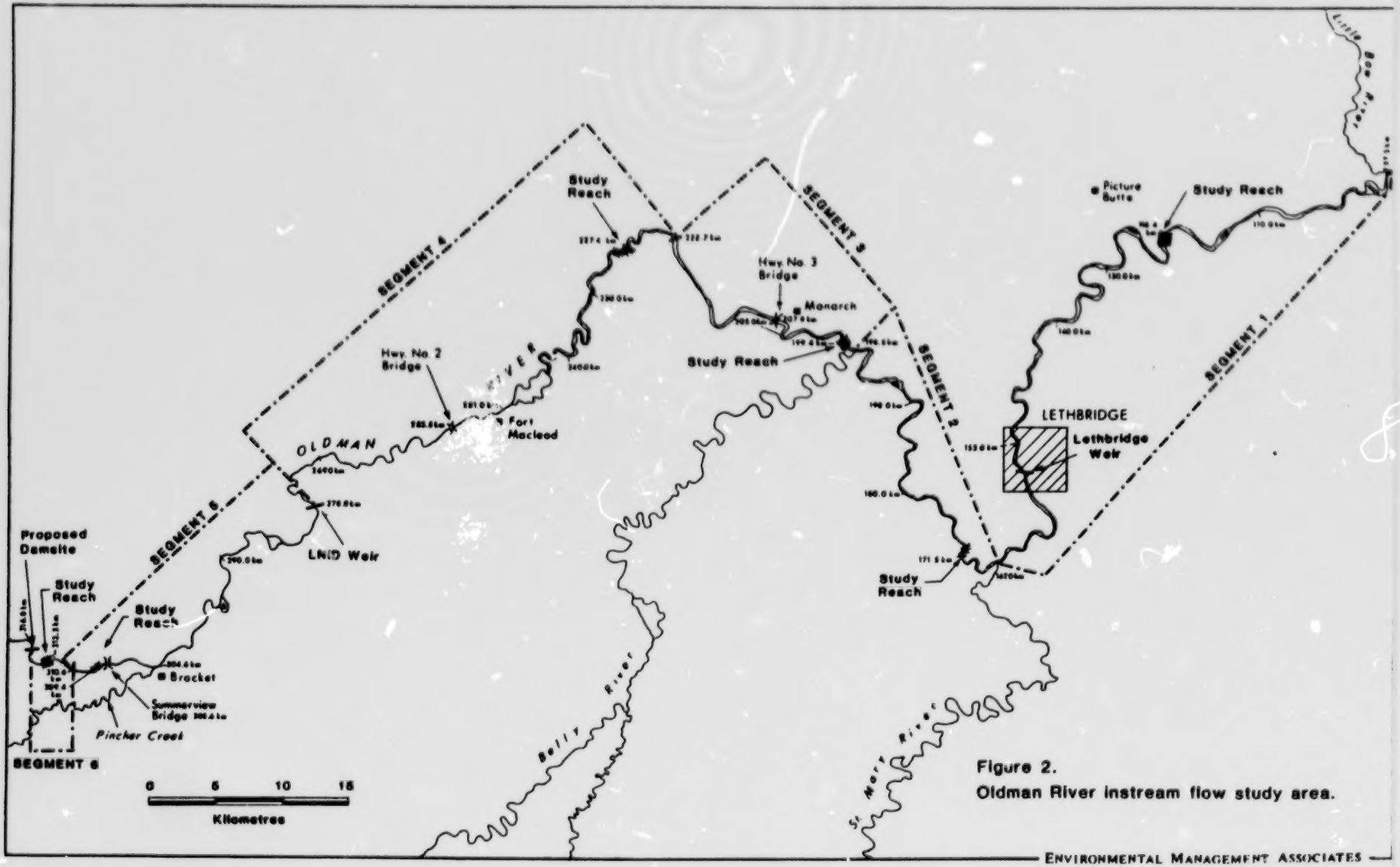

Figure 2.
Oldman River instream flow study area.

1. Document the extent of rainbow trout spawning activity in the mainstem of the Oldman River between the proposed damsite and the Highway 2 crossing.

2. Locations of identified rainbow trout redds will be mapped, and measurements made of redd size and proximity to shore; at active redds, microhabitat parameters will be measured (depth, velocity, substrate).

3. Captured fish will be identified to species, and sport fish tagged with an Alberta Environment reward tag prior to release. Depending on field conditions and numbers encountered, sport fish will be either measured to fork length or subjectively classified to life stage (adult, juvenile, young-of-year).

4. The results will describe sport fish species compositions, distributions, relative abundance, and habitat utilization within the study area.

5. These data will be related to the results of previous fisheries studies completed in the study area.

The spring study was conducted downstream of the damsite to the Highway 2 bridge crossing (Figure 2). Data were collected in two phases. From 7 to 12 April distribution and abundance of sport fish was determined by boat electrofishing. Electrofishing and radio tracking were conducted to detect movements of adult rainbow trout to spawning areas. During this period water temperature was rising, flows were similar to normal winter flow, and turbidity was low. The visibility allowed evaluation of river bottom in the context of potential rainbow trout spawning substrate. This evaluation was performed concurrent to electrofishing. Also during the first period of field studies, tributaries to the Oldman River were investigated and assessed for rainbow trout spawning and migration potential.

The second period of field studies commenced on 22 April when water temperatures were suitable for rainbow trout spawning, and continued to 24 April. Spawning activities were taking place upstream in the Crowsnest River at this time (J. O'Neil, pers. comm.). Water levels in the Oldman River were rising in late April, and turbidity was high. Boat electrofishing was conducted from the proposed damsite downstream to LNID and in Pincher Creek to determine distribution, abundance and stage of maturity of sport fish. Radio-tracking surveys were conducted by boat and fixed-wing aircraft to determine the location of previously tagged adult rainbow trout.

4.0 METHODS

4.1 SPECIES DISTRIBUTION AND ABUNDANCE

Winter fisheries inventory studies on the Oldman River were conducted from 28 February to 16 March by a two or sometimes three-person crew. The four river segments between the Oldman River Damsite and the confluence with the Belly River, as defined in the previous IFN study (Fernet and Matkowski 1986) (Figure 1), were sampled by boat and backpack electrofishing and gill netting. Boat electrofishing was used extensively as it proved to be the most effective sampling method under conditions of high discharge. The total length of each segment within the study area was sampled at least once by boat electrofishing. Water temperatures were recorded daily to determine potential influence on fish distribution (Appendix I, Table 1). A list of common and scientific names of fish species included in this report may be found in Appendix I, Table 2.

Initial spring investigations of rainbow trout distribution and abundance were conducted from 7 to 12 April. The study area extended from the proposed damsite downstream to the Highway 2 bridge [Segments 5, 6 and part of 4, as defined in the previous Instream Flow Needs study (Fernet and Matkowski 1986)] (Figure 2). The entire study area including the lower portion of Pincher Creek was sampled using a boat electrofisher. The upstream area [the proposed damsite (km 316.0) down to Summerview Bridge (km 308.6)] was sampled several times. Sport fish which were captured in good condition were tagged with numbered floy tags (Floy Model FD68-B) and released. One large adult rainbow trout was tagged with a radio transmitter; two fish had been similarly tagged and released during winter studies in March. Radio tracking by boat was conducted over the entire study area to monitor movements of the recently tagged rainbow trout, and to determine the locations of those tagged in March.

From 22 to 24 April species distribution and abundance was again investigated by boat electrofishing. Since no adult rainbow trout were

captured downstream of LNID earlier in April, sampling was conducted only in Segments 5 and 6. Emphasis was placed on areas where suitable spawning substrate had been identified previously. Radio tracking was conducted by boat in Segments 5 and 6 and in Pincher Creek. One tracking survey was conducted by fixed-wing aircraft; areas surveyed included the Oldman River mainstem, the Crowsnest River and the Castle River (as described below).

Water temperatures were recorded daily throughout field studies to determine potential influences on fish distribution (Appendix I, Table 3).

4.1.1 Electrofishing

A 3 000 watt boat-mounted electrofisher (Smith-Root Model 3.5 GPP) was used to locate and collect fish. The boat electrofisher was mounted on a 5.5-m long Glascon fibreglass riverboat powered by a 80HP jet-driven Mercury outboard motor. Effort was recorded in seconds. Captured fish were transferred to tubs filled with fresh river water, where they were maintained until sampling (not more than 30 minutes following capture). A backpack electrofisher (Smith-Root Type VII) was used during winter studies only, in shallow backwaters or along river banks to sample habitat not accessable by boat electrofisher. Effort was also recorded in seconds.

Sampling locations, dates and effort for boat and backpack electrofishing in winter, and boat electrofishing in spring are summarized in Appendix I, Tables 4,5 and 6 respectively.

4.1.2 Radio Telemetry

Two large adult rainbow trout were tagged with radio transmitters during winter studies in March. A third such rainbow trout was radio tagged on 10 April, 1986. Transmitters were attached externally at the

base of the dorsal fin by means of two floy anchor tags (Model FD68-B). Fish were not anesthetized during tagging in an effort to reduce delay and handling time. A summary of information regarding radio tagging is presented in Appendix I, Table 7.

Radio tracking was conducted by boat while travelling up or down river between the proposed damsite and the Highway 2 bridge from 7 to 12 April, and again from the proposed damsite to LNID on 22 to 23 April. One tracking survey was conducted by fixed-wing aircraft (Cessna C172) on 24 April,1986. Areas surveyed by aircraft included the Oldman River from km 290 upstream to the North Fork Bridge, the Crowsnest River from the mouth to Lundbreck Falls, and the Castle River from the mouth to Beaver Mines.

4.1.3 Gill Netting

Gill netting was conducted during winter only. Nets were set in deep areas where velocity was low enough to prevent net drift. Appropriate sites were limited by high velocities; locations are illustrated in Figure 3. Nets were oriented perpendicular to shore and were fished overnight for approximately 12 hours. The gill nets employed were all 15.2-m long by 2.4-m deep and constructed of monofilament nylon. Mesh sizes were 6.4 and 7.6-cm stretched measured. A record of gill-netting locations, mesh sizes and duration of sets is presented in Appendix I, Table 8.

4.1.4 Fish Handling Procedures

All captured fish were identified to species, and where possible, living specimens were identified to life stage, sex and state of maturity. Rough fishes were counted and released. A representative sample of each life-history stage of each species was analysed as follows. Length was measured (fork length to the nearest mm), scale samples were taken (except mountain whitefish in spring), and all fish over 250 mm and in good condi-

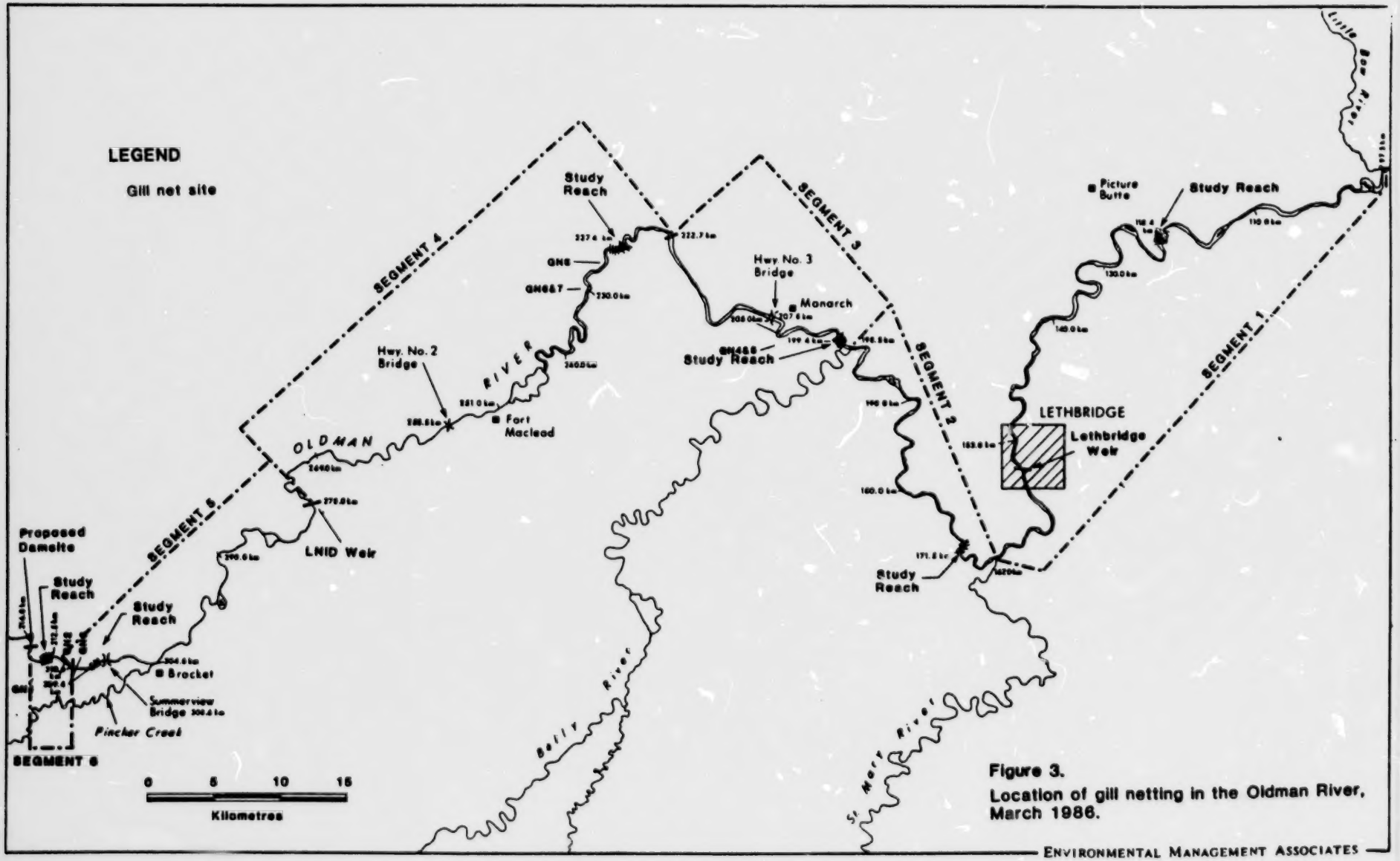

Figure 3.
Location of gill netting in the Oldman River, March 1986.

tion were tagged with numbered floy tags (Model FD68-B). Fish were subsequently released. Summaries of numbers and species of fish tagged in winter and spring are presented in Appendix I, Tables 9 and 10, respectively. Those fish not captured in good condition were measured and released immediately.

In winter, the few individuals which died as a result of capture were analysed as follows. Each fish was measured (fork length to the nearest mm), weighed with a hand-held scale (to the nearest g), and the sex, life-history stage, state of maturity and stomach contents determined by internal examination.

In spring, samples of 10 adults each of mountain whitefish, longnose sucker and white sucker were collected, weighed and frozen as quickly as possible (less than 24 hours) for mercury analysis. A sample of 8 rainbow trout, each over 300-mm long (fork length) was also collected and frozen for mercury analysis. A summary of fish numbers, fork lengths and weights of fish collected for mercury analysis is presented in Appendix I (Table 11).

4.1.5 Data Processing

All data were recorded directly into field books, and transcribed daily to 80 column computer data sheets while in the field. Data were input to a microcomputer system programmed for validation of the input data. Storage of all data was on microcomputer floppy disks, and in printed form.

Formulae employed to calculate Catch-Per-Unit-Effort (CPUE) statistics are as follows: electrofishing - number of fish captured/100 seconds of electrofishing; gill netting (per net) - number of fish captured/hour of sampling.

4.2 WINTER HABITAT CHARACTERISTICS

During the winter survey, sections of the river where significant numbers or concentrations of sport fish were located were identified as areas of suitable habitat. Sites where 20 or more individuals were located within a confined area (e.g., 10 m length of river), or where fish were consistently captured at a lower density but over a greater length of river (e.g., 50 fish in 100 m) were classified as "Habitat Areas". Mountain whitefish were the most common sport species found in Habitat Areas; one or two individuals of less common species such as rainbow trout were occassionally captured within Habitat Areas. Each of these Habitat Areas was numbered and its location recorded on 1:50 000 National Topographic Series (NTS) maps. Sport species located in each Habitat Area were enumerated and recorded.

Detailed measurements of habitat parameters were conducted in as many Habitat Areas as possible, with emphasis on sampling a wide variety of types within the following three categories: riffle, run, pool. Some Habitat Areas which were typical of those previously measured were classified to category, and due to time constraints only length and width were estimated. A list of each Habitat Area identified, category, sport species found, area and whether detailed measurements were made is located in Appendix I, Table 12. Figure 4 illustrates locations of all Habitat Areas identified.

4.2.1 Detailed Habitat Measurement

In Habitat Areas where detailed measurements were performed, a sketch was made of the location and extent of river in which sport fishes were found. Transects were placed at the upstream and downstream limits of the area, and at one location which was most representative of the habitat present. Length of each river bank between the limiting transects was chained using a 100 m tape measure. River width at each transect was estimated by each of the two crew members; the mean of the two estimates was

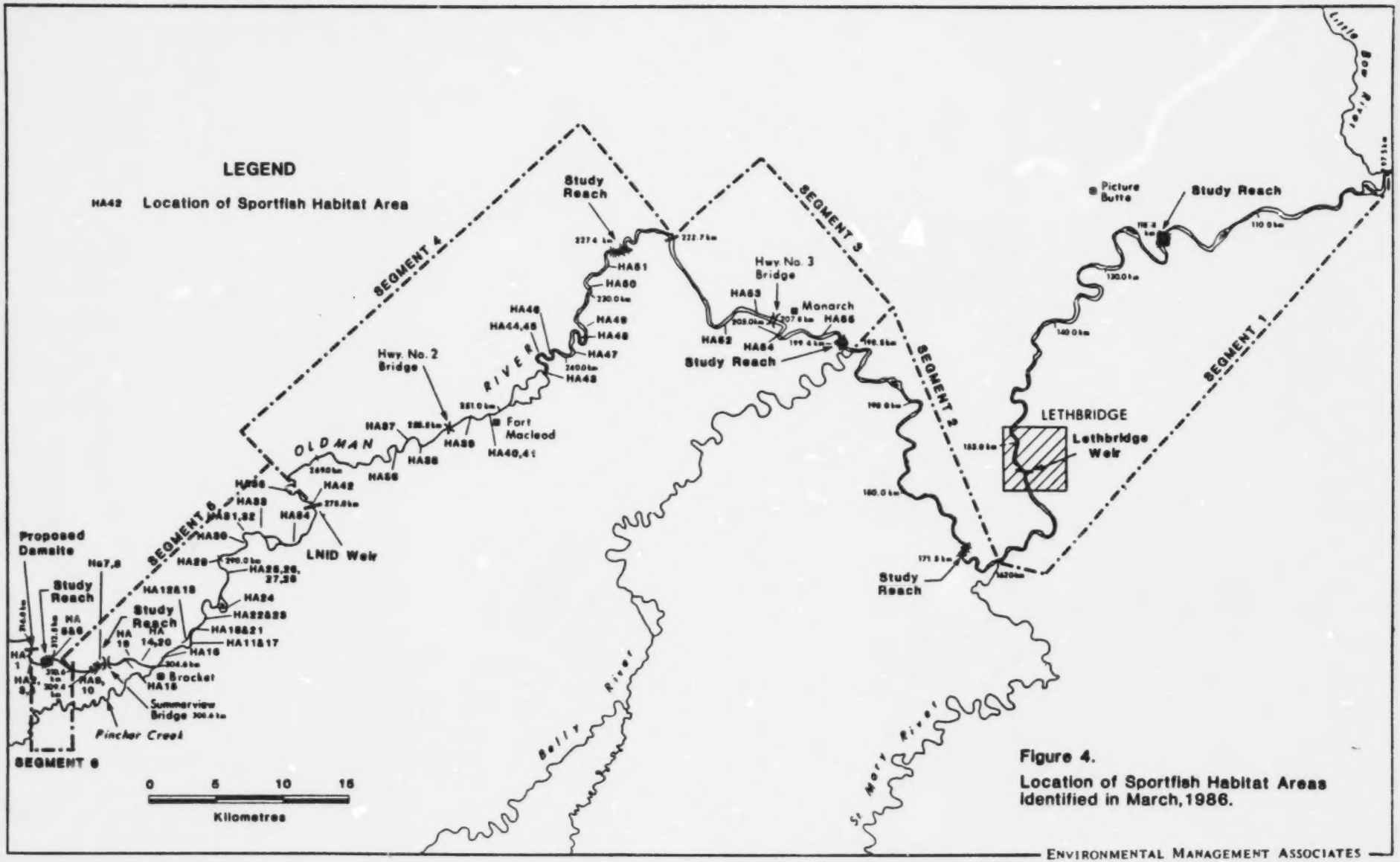

Figure 4.
Location of Sportfish Habitat Areas identified in March, 1986.

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then recorded as width. From these measurements and estimates mean length (m), mean width (m), and area (m^2) of the Habitat Area were calculated. At 1/3 and 2/3 of river width across each of the three transects, water velocity and depth measurements were recorded. Water velocity was measured using Water Survey of Canada standards, which include measurement at 0.6 depth where depth is less than 0.75 m, and at 0.2 and 0.8 depth where depth exceeds 0.75 m (Terzi 1981). Velocity measurements were performed using Price Type AA current meters attached to a top-setting wading rod or a cable suspension system with a 6.8-kg weight suspended below the Price meter.

Two or three points at which sport fish were located were sampled to define utilized habitat in each Habitat Area. Water depth and velocity were measured as described above, and substrate and cover characteristics were determined. The substrate and cover classifications employed are summarized on Table 2. If the representative transect was located where sport fish had been found, substrate and cover were also analysed at 1/3 and 2/3 transect width.

4.3 RAINBOW TROUT SPAWNING HABITAT EVALUATION

Between 7 and 12 April river substrate was evaluated in terms of suitability for rainbow trout spawning. Substrate particle sizes between small gravel (2.0 to 8.9 mm) and small cobbles (64.0 to 128.0 mm) were considered suitable; heavily silted or algae-covered substrate was not. Areas of suitable substrate were recorded on 1:50 000 NTS maps. During the same study period, tributaries to the Oldman River were investigated and assessed for rainbow trout spawning and migration potential (Figure 5). Width and depth of each stream mouth was recorded, as well as the suitability of substrate for spawning use. Where fish passage appeared possible, upstream areas of the stream were investigated by boat or on foot.

TABLE 2

SUBSTRATE AND COVER CLASSIFICATION CRITERIA

Substrate

Recorded as percent composition.

Category	Code	Size range (mm)
detritus	0	-
clay/silt	1	<0.062
sand	2	0.062-2.0
small gravel	3	2.0-8.0
medium gravel	4	8.0-32.0
large gravel	5	32.0-64.0
small cobble	6	64.0-128.0
large cobble	7	128.0-256.0
small boulder	8	256.0-762.0
large boulder	9	>762.0
bedrock	10	-

Cover

Recorded as percent of area with each cover type; recorded separately for rainbow trout fry, juveniles, adults and mountain whitefish fry, juveniles, adults

Category	Cover type
SB	substrate cover (e.g., cobbles, boulders)
LB	log and branch debris
LJ	log jam
RW	root wad
UB	undercut bank
OV	overhanging bank vegetation
AG	attached algae
VF	floating vascular plants
VS	submerged vascular plants
VE	emergent vascular plants
BW	backwater

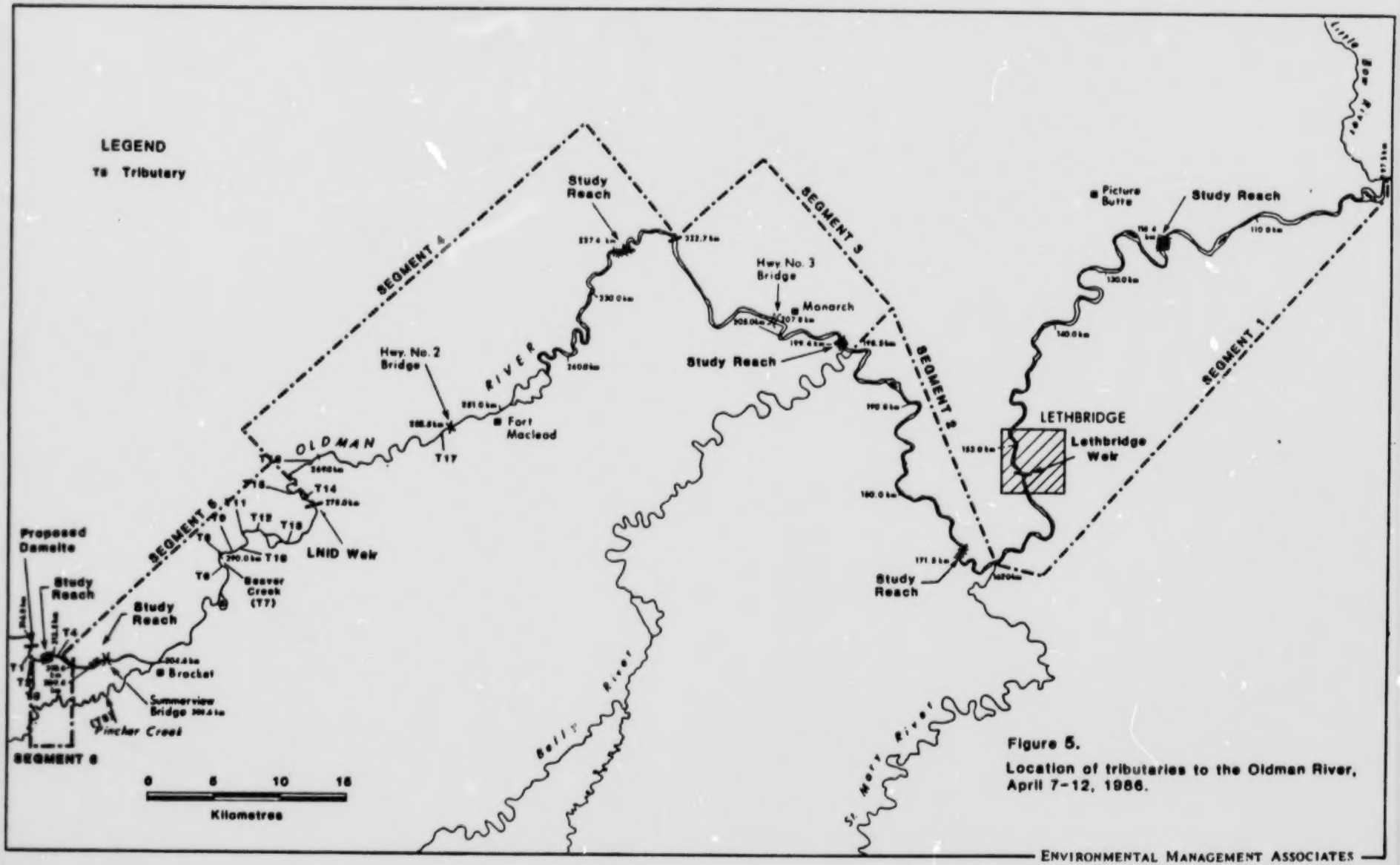

Figure 5.
Location of tributaries to the Oldman River, April 7-12, 1986.

5.0 RESULTS

5.1 WINTER SPECIES DISTRIBUTION AND ABUNDANCE

The distribution and abundance of each sport species in the study area was determined through a consideration of all sampling methods since effectiveness of each sampling technique varied with species and life-history stage. The results of fisheries inventory studies conducted in winter are summarized according to sampling method.

Detailed catch or observation records for each method are provided in Appendix I, Tables 4, 5, and 8. Tables 3 and 4 in text are summaries of boat and backpack electrofishing results respectively, and include CPUE statistics. Table 5 is a summary of gill-net sampling. Very few fish were captured in gill nets, perhaps due to fouling of nets with debris. The distribution and abundance of sport fishes in the study area is presented below by species and life-history stage.

5.1.1 Mountain Whitefish

Adult and juvenile mountain whitefish were captured in all four segments of the study area in March, 1986. Boat electrofishing CPUE for adults was greater in Segments 5 and 6 than 3 and 4, while CPUE for juveniles was notably lower only in Segment 3 (Table 3). It appears that adult mountain whitefish were most abundant in the upper two segments of the study area, and that juveniles were most abundant in the upper three segments.

The boat electrofishing CPUE results for adults to juveniles was approximately equal in both Segments 6 and 3. In Segment 4, the CPUE for juveniles was notably greater and in Segment 5 was slightly greater than that for adults (Table 3). It appears that proportions of adults and juveniles in Segments 3 and 6 were approximately equal, while juveniles were more abundant than adults in Segments 4 and 5.

TABLE 3

SUMMARY OF BOAT ELECTROFISHING RESULTS, OLDMAN RIVER, MARCH, 1986

Segment	Total Sampling Effort(s)	CATCH (Total No. of individuals) Catch-per-unit-effort (No./100s)									
		Lake Whitefish	Mountain Whitefish			Rainbow Trout		Brown Trout	Bull Trout	Northern Pike	
		Ad[a]	F	Juv	Ad	Juv	Ad	Ad	Ad	Juv	Ad
3	6217		(4)0.06	(136)2.19	(128)2.06	(1)0.02					(1)0.02
4	13650	(1)0.01	(3)0.02	(763)5.59	(416)3.05	(5)0.04	(4)0.03				(1)0.01
5	14009	(14)0.10	(2)0.01	(1112)7.94	(986)7.04	(26)0.19	(51)0.36	(1)0.01		(1) 0.01	(8)0.06
6	1627			(100)6.15	(106)6.51	(1)0.06	(10)0.61	(1)0.06	(1) 0.06		
TOTAL	35503	(15)0.04	(9)0.02	(2111)5.95	(1636)4.61	(33)0.09	(65)0.18	(2)0.01	(1)<0.01	(1)<0.01	(10)0.03

continued . . .

Table 3 (concluded)

Segment	Total Sampling Effort(s)	CATCH (Total No. of individuals) Catch-per-unit-effort (No./100s)								
		Longnose Sucker Ad	White Sucker Juv	White Sucker Ad	Mountain Sucker Ad	Shorthead Redhorse Ad	Burbot Ad	Spoonhead Sculpin Ad	Unknown Ad	TOTAL
3	6217	(34)0.55		(32)0.51		(3)0.05	(1)0.02			(340)5.47
4	13650	(78)0.57	(2)0.01	(111)0.81		(8)0.06	(1)0.01			(1393)10.20
5	14009	(232)1.66		(156)1.13			(1)0.01		(50)0.36	(2640)18.84
6	1627	(28)1.72			(2)0.12			(1) 0.06		(250)15.37
TOTAL	35503	(372)1.05	(2)0.01	(299)0.84	(2)0.01	(11)0.03	(3)0.01	(1)<0.01	(50)0.14	(4623)13.02

[a] Life history stage: F = Fry
Juv = Juvenile
Ad = Adult

TABLE 4

SUMMARY OF BACKPACK ELECTROFISHING RESULTS, OLDMAN RIVER, MARCH, 1986

Segment	Total Sampling Effort(s)	CATCH (Total No. of individuals) Catch-per-unit-effort (No./100s)										
		Mountain Whitefish F[a]	Juv	Longnose Dace Juv	Ad	Mountain Sucker Juv	Ad	Trout-Perch Juv	Ad	Burbot Juv	Unidentified Cyprinidae	TOTAL
5	1563	(1)0.06	(78)4.99	(9)0.58	(14)0.90	(10)0.64	(2)0.13	(3)0.19	(9)0.58	(1)0.06	(2)0.13	(129)8.25
TOTAL	1563	(1)0.06	(78)4.99	(9)0.58	(14)0.90	(10)0.64	(2)0.13	(3)0.19	(9)0.58	(1)0.06	(2)0.13	(129)8.25

[a] Life History: F = Fry
Juv = Juvenile
Ad = Adult

TABLE 5

SUMMARY OF GILL-NET SAMPLING RESULTS, OLDMAN RIVER, MARCH, 1986

Segment	No. Nets Set	Duration (h)	CATCH (Total No. of individuals) Catch-per-unit-effort (No./panel-h)[a] Mountain Whitefish Juv[b]	Whitefish Ad	Rainbow Trout Ad	Bull Trout Ad	Northern Pike Ad	Longnose Sucker Juv	Sucker Ad	White Sucker Juv	TOTAL
3	2	34.92		(1)0.03			(1)0.03				(2)0.06
4	3	50.65	(1)0.02	(1)0.02							(2)0.04
6	3	46.69		(2)0.04	(2)0.04	(1)0.02		(1)0.02	(6)0.13	(2)0.04	(14)0.30
TOTAL	8	132.26	(1)0.01	(4)0.03	(2)0.01	(1)0.01	(1)0.01	(1)0.01	(6)0.04	(2)0.01	(18)0.14

[a] All panels were 15.2 m in length and 2.4 m in depth.

[b] Life History Stages: Juv = Juvenile
Ad = Adult

Mountain whitefish fry were captured in Segments 3, 4 and 5 (Tables 3 and 4) in March, 1986. Few fry were located in any of these segments.

5.1.2 Rainbow Trout

Adult rainbow trout were captured in Segments 4, 5 and 6 in March, 1986. Boat electrofishing CPUE results indicate that abundance of adults decreased with distance downstream (Table 3). Juvenile rainbow trout were captured in all four segments of the study area. Juveniles were most abundant in Segment 5; only a few individuals were captured in the remainder of the study area (Table 3). Adult rainbow trout appear to have been significantly more abundant than juveniles in Segments 5 and 6, and equally abundant in Segments 3 and 4 (Table 3).

No rainbow trout fry were captured or observed during winter inventory although suitable habitat was sampled by both boat and backpack electrofishing.

5.1.3 Other Sport Species

One adult bull trout was captured in Segment 6 during boat electrofishing (Table 3). The same fish was recaptured in the same location while gill netting the following day (Table 5). One adult brown trout was captured in each of Segments 5 and 6 while boat electrofishing (Table 3). Fourteen adult lake whitefish were captured while boat electrofishing in Segment 5, and one adult was captured in Segment 4 (Table 3). Eleven northern pike adults were captured in Segments 3, 4 and 5 (Tables 3 and 5). One juvenile northern pike was captured in Segment 5.

5.2 WINTER HABITAT CHARACTERISTICS AND UTILIZATION

A summary of habitat characteristics measured at the representative transects in each Habitat Area is presented by category (riffle, run, pool) for each segment in Table 6. Summaries of habitat characteristics measured at points where mountain whitefish were located in each Habitat Area are presented as utilized habitat by category for each segment in Table 7. A similar summary for rainbow trout is presented in Table 8. Appendix II contains detailed measurements for each Habitat Area.

Appendix I, Table 12 provides a list of Habitat Areas identified during the study. Of the 55 Habitat Areas identified, all those in Segments 5 and 6 (upstream of LNID) contained both adult and juvenile mountain whitefish. Neither adults nor juveniles appeared more abundant in any particular habitat category (riffle, pool or run). Runs comprised the greatest number of Habitat Areas, 20, while pools comprised 10 and riffles only 4. Downstream of LNID (Segment 4) there were notably fewer adult than juvenile mountain whitefish in all habitat categories, and in two of the Habitat Areas (both runs) only juveniles were present. Once again runs comprised most Habitat Areas, 11, while riffles comprised 8 and pools only 1.

Although a few rainbow trout were captured downstream of LNID, none were present in defined Habitat Areas. Upstream of LNID adult rainbow trout were captured in all three habitat types with no apparent preference for category. Only two juvenile rainbow trout were captured in Habitat Areas, both in runs. A few other sport species were captured in Habitat Areas. One adult bull trout was utilizing a riffle, while one adult brown trout was utilizing a pool. Three adult lake whitefish and one adult northern pike were all captured in pools.

5.3 SPRING SPECIES DISTRIBUTION AND ABUNDANCE

Distribution and abundance of fish species in the study area during the spring was determined by boat electrofishing, as this was the most

TABLE 6

CHARACTERISTICS OF REPRESENTATIVE HABITATS, OLDMAN RIVER STUDY AREA, WINTER, 1986

Segment	Species Present[a]	Habitat Category	No. of Habitat Areas Sampled	Characteristics of Representative Habitat					
				Depth (m)		Velocity (m/s)		Substrate Composition (%)[b]	Cover (%)[c]
				Mean	Range	Mean	Range		
6	MTWF, RBTR	Pool	2	1.09	0.98-1.21	0.119	0.041-0.278	S1100	0
6	MTWF, RBTR, BULL	Riffle	2	1.31	1.23-1.38	1.576	1.448-1.703	MG5, LG15, SC44, LC36	F28, J9, A4
6	MTWF, RBTR	Run	2	1.09	0.94-1.25	1.024	0.941-1.107	SG4, MG5, LG15, SC24, LC17, SB25, LB10	F27, J18, A11
5	MTWF, RBTR	Pool	3	1.97	0.97-2.68	0.342	0.036-0.605	S149, SG10, MG8, LG8, SC6, LC1, SB2, LB16	F13, J4, A3
5	MTWF, RBTR	Riffle	?	0.95	0.79-1.11	1.244	1.091-1.397	Sa7, SG15, MG10, LG21, SC15, LC20, SB12	F37, J14, A6
5	MTWF, RBTR	Run	6	0.99	0.80-1.18	0.876	0.508-1.343	S11, SG5, MG15, LG32, SC26, LC12, SB2, LB3, Bed4	F20, J10, A2
4	MTWF	Riffle	3	0.85	0.71-1.08	1.075	0.947-1.174	SG2, MG13, LG33, SC22, LC30	F40, J18, A8
4	MTWF	Run	7	0.87	0.64-1.23	0.949	0.815-1.261	S11, SG5, MG11, LG23, SC20, LC28, SB12	F38, J23, A14
3	MTWF	Riffle	3	0.64	0.53-0.77	0.881	0.704-0.989	SG2, MG8, LG25, SC28, LC27, SB5, LB5	F33, J18, A10

[a] MTWF - mountain whitefish, RBTR - rainbow trout, BULL - bull trout
[b] Substrate Categories: Si - silt; Sa - sand; G - gravel; C - cobble; B - boulder; Bed - bedrock
Sizes: S - small; M - medium; L - large
[c] Life History Stages: F - fry; J - juvenile; A - adult

TABLE 7

CHARACTERISTICS OF HABITAT UTILIZED BY MOUNTAIN WHITEFISH, OLDMAN RIVER STUDY AREA, WINTER, 1986

Segment	Habitat Category	No. of Areas Sampled	Characteristics of Utilized Habitat[a]					
			Depth (m)		Velocity (m/s)			
			Mean	Range	Mean	Range	Composition (%)[b]	Cover (%)[c]
6	Pool	2	1.23	1.22-1.24	0.119	0.042-0.197	Si100	0
6	Riffle	2	0.81	0.77-0.86	0.766	0.495-1.038	Si14, MG3, LG11, SC40, LC32	F28, J14, A6
6	Run	2	0.95	0.70-1.2	0.691	0.670-0.711	Si10, SG1, MG2, LG14, SC17, LC25, SB18, LB13	F28, J18, A11
5	Pool	3	1.51	1.14-2.17	0.156	0.024-0.292	Si60, SG9, MG7, LG9, SC8, LC4, SB3	F5, J2, A1
5	Riffle	2	0.75	0.56-0.94	0.753	0.575-0.932	Sa10, SG6, MG7, LG20, SC16, LC39, SB2	F22, J11, A5
5	Run	6	0.83	0.56-1.20	0.731	0.395-1.007	Si1, SG1, MG10, LG26, SC25, LC23, SB3, LB2, Bed9	F23, J13, A8
4	Riffle	3	0.78	0.64-1.03	1.094	0.902-1.253	SG3, MG11, LG36, SC22 LC23, SB5	F42, J21, A9
4	Run	7	0.86	0.49-1.13	0.968	0.803-1.113	Si3, SG2, MG4, LG16, SC22, LC36, SB17	F45, J27, A16
3	Riffle	3	0.74	0.55-0.85	1.066	0.962-1.149	MG3, LG17, SC27, LC21, SB14, LB8, Bed10	F42, J28, A19

[a] "Utilized" Habitat: measurements done where fish were observed.
[b] Substrate Categories: Si-Silt, Sa-sand, G-gravel, C-cobble, B-boulder, Bed-bedrock.
Sizes: S-small, M-medium, L-large
[c] Life History Stages: F-Fry, J-Juvenile, A-Adult

TABLE 8

CHARACTERISTICS OF HABITAT UTILIZED BY RAINBOW TROUT, OLDMAN RIVER STUDY AREA, WINTER, 1986

Segment	Habitat Category	No. of Areas Sampled	Characteristics of Utilized Habitat[a] Depth (m) Mean	Depth (m) Range	Velocity (m/s) Mean	Velocity (m/s) Range	Composition (%)[b]	Cover (%)[c]
6	Pool	1	1.22	-	0.197	-	Si100	0
6	Riffle	1	0.86	-	0.495	-	Si35, MG3, LG12, SC28, LC22	F15, J5, A2
6	Run	1	0.70	-	0.670	-	Si20, SG1, MG4, LG25, SC23, LC25, SB2	F20, J13, A5
5	Pool	2	1.65	1.14-2.16	0.088	0.024-0.152	Si48, SG12, MG10, LG12, SC13, LC5	F5, J2, A1
5	Riffle	1	0.94	-	0.575	-	Sa17, SG10, MG8, LG10, SC17, LC35, SB3	F20, J8, A4
5	Run	3	0.97	0.71-1.20	0.729	0.395-1.007	Si2, SG1, MG7, LG24, SC20, LC13, SB6, LB5, Bed 22	F26, J16, A10

[a] "Utilized" Habitat: measurements done where fish were observed.
[b] Substrate Categories: Si-Silt, Sa-sand, G-gravel, C-cobble, B-boulder, Bed-bedrock.
Sizes: S-small, M-medium, L-large
[c] Life History Stages: F-Fry, J-Juvenile, A-Adult

efficient means of capture of adult sport species at that time. Smaller species or individuals generally present in shallow inaccessable areas of the river were rarely captured. Detailed catch records may be found in Appendix I, Table 6. Physical conditions in the river were significantly different between the two periods of field studies; poor visibility and high discharges between 22 to 24 April decreased electrofishing CPUE to values which were unrepresentative of actual fish abundance. As a result, summaries of electrofishing are presented separately for the periods from 8 to 12 April and 22 to 24 April (Tables 9 and 10, respectively). The distribution and abundance of sport fishes in the study area is presented below by species and life-history stage.

5.3.1 Mountain Whitefish

Adult and juvenile mountain whitefish were captured in all three segments of the study area; juveniles were also captured in Pincher Creek (Tables 9 and 10). CPUE for adults and juveniles decreased from upstream to downstream segments; relatively few individuals were captured in Segment 4 and Pincher Creek. Mountain whitefish fry (i.e., 1985 year class) were captured in small numbers in Segments 5 and 6.

5.3.2 Rainbow Trout

Rainbow trout were captured in Segments 4, 5 and 6, and in Pincher Creek during spring electrofishing (Tables 9 and 10). Few individuals were captured in any area. Adults were captured only in Segments 5 and 6, and appear to have been equally abundant in both segments. Juvenile rainbow trout were captured in all three segments, and in Pincher Creek. CPUE for juveniles was greatest in Segments 5 and 6 of the Oldman River mainstem. The CPUE was high in Pincher Creek, likely due to the small sampling effort in that area. No rainbow trout fry (i.e., 1985 year class) were captured. Radio tracking for tagged rainbow trout was unsuccessful. Battery malfunction was the likely cause of signal failure.

TABLE 9

SUMMARY OF BOAT ELECTROFISHING RESULTS, OLDMAN RIVER, APRIL 8-12, 1986

Segment	Total Sampling Effort(s)	CATCH (Total No. of Individuals) Catch-per-unit-effort (no./100s)									
		Lake Whitefish	Mountain Whitefish			Rainbow Trout		Brown Trout		Bull Trout	
		A[a]	F	Juv	Ad	J	Ad	Juv	Ad	Juv	Ad
Pincher Ck.	411	(1)0.24		(2)0.49		(4)0.97					
4	5331			(51)0.96	(23)0.43	(2)0.04					
5	12010	(2)0.02	(6)0.05	(894)7.44	(648)5.40	(10)0.08	(16)0.13		(4)0.03	(1)0.01	(1)0.01
6	2767		(2)0.07	(309)11.17	(235)8.49	(8)0.29	(4)0.14	(1)0.04	(3)0.11		(2)0.07
TOTAL	20519	(3)0.01	(8)0.04	(1256)6.12	(906)4.42	(24)0.12	(20)0.10	(1)<0.01	(7)0.03	(1)<0.01	(3)0.01

continued . . .

Table 9 (concluded)

Segment	Total Sampling Effort(s)	CATCH (Total No. of Individuals) Catch-per-unit-effort (no./100s)								
		Unidentified Trout		Northern Pike		Longnose Sucker	White Sucker		Burbot	TOTAL
		Juv	Ad	Juv	Ad	Ad	Juv	Ad	Ad	
Pincher Ck.	411				(1)0.24	(31)7.54		(61)14.84		(100)24.33
4	5331					(15)0.28		(18) 0.34		(109)2.05
5	12010		(1)0.01	(1)0.01	(1)0.01	(176)1.47	(32)0.27	(199) 1.66		(1992)16.59
6	2767	(1)0.04				(144)5.20		(76) 2.75	(1)0.04	(786)28.41
TOTAL	20519	(1)<0.01	(1)<0.01	(1)<0.01	(2)0.01	(366)1.78	(32)0.16	(354) 1.73	(1)<0.01	(2987)14.56

[a] Life-history stage: F = Fry
Juv = Juvenile
Ad = Adult

TABLE 10

SUMMARY OF BOAT ELECTROFISHING RESULTS, OLDMAN RIVER, APRIL 22-24, 1986[a]

Segment	Total Sampling Effort (s)	Catch (Total No. of Individuals) Catch-per-unit-effort (no./100s)							
		Lake Whitefish	Mountain Whitefish			Rainbow Trout		Brown Trout	Bull Trout
		Ad[b]	F	Juv	Ad	Juv	Ad	Juv	Ad
Pincher Ck	351	(2)0.57		(11)3.13					
5	11510	(5)0.04	(5)0.04	(305)2.65	(117)1.02	(11)0.10	(5)0.04	(2)0.02	(1)<0.01
6	2230		(1)0.04	(85)3.81	(31)1.39	(1)0.04			
TOTAL	14091	(7)0.05	(6)0.04	(401)2.85	(148)1.05	(12)0.09	(5)0.04	(2)0.01	(1)<0.01

continued . . .

Table 10 (concluded)

Segment	Total Sampling Effort (s)	CATCH (Total No. of Individuals) Catch-per-unit-effort (no./100s) Northern Pike Ad	Longnose Sucker Ad	White Sucker Ad	White Sucker F	Burbot Juv	TOTAL
Pincher Ck	351		(7)3.51		(2)0.57		(22)6.27
5	11510	(5)0.04	(81)0.70	(27)0.23	(83)0.72	(5)0.04	(652)5.66
6	2230		(34)1.52	(2)0.09	(4)0.18		(158)7.09
TOTAL	14091	(5)0.04	(122)0.87	(29)0.21	(89)0.63	(5)0.04	(832)5.90

[a] High turbidity during this sampling period resulted in low Catch-Per-Unit-Effort values.
[b] Life-history Stage: F = Fry
Juv = Juvenile
Ad = Adult

5.3.3 Other Sport Species

Adult and juvenile brown trout were captured in the study area during spring electrofishing (Table 9 and 10). Adult brown trout were captured in Segments 5 and 6, while juveniles were captured in Segment 6 only. Few individuals were captured in any area. A few bull trout were captured in Segments 5 and 6 (Tables 9 and 10). Both adults and juveniles were captured in Segment 5; adults only were captured in Segment 6. Lake whitefish were captured in Pincher Creek and in Segment 5 (Tables 9 and 10). CPUE results appeared high in Pincher Creek due to the small area sampled and the resultant small sampling effort. The number of individuals captured was still very low. Adult northern pike were also captured in low numbers in Pincher Creek and Segment 5. Again, the CPUE in Pincher Creek was high due to the low sampling effort. One juvenile northern pike was captured in a blind channel off the Oldman River mainstem of Segment 5 (Table 9).

5.4 RAINBOW TROUT SPAWNING HABITAT AVAILABILITY AND USE

Within the mainstem of the Oldman River suitable rainbow trout spawning substrate was most common in Segments 5 and 6. Segment 4 near LNID had substrate of suitable size, but the substrate was compacted at this locale. Further downstream in Segment 4, substrate of suitable size was less abundant and commonly covered with silt. Tributaries to the Oldman River were assessed individually for rainbow trout spawning potential (Table 11, Figure 5). Most tributaries were small, intermittent, and did not provide suitable spawning habitat. Only Beaver and Pincher creeks were evaluated as providing potential for rainbow trout spawning.

No evidence of rainbow trout spawning activity in the mainstem study area or tributaries was found during studies from 22 to 24 April. Very few adult rainbow trout were captured in the mainstem during that period, and none were found in tributaries. Gonads of captured fish were developed but none were close to spawning. Identification of spawning

TABLE 11

POTENTIAL RAINBOW TROUT SPAWNING HABITAT IN TRIBUTARIES TO THE OLDMAN RIVER BETWEEN THE PROPOSED OLDMAN RIVER DAMSITE AND HIGHWAY 2 BRIDGE, APRIL 7-12, 1986

Watercourse[a]	Description	Limitations to Fish Access	Type and Size of Spawning Habitat	Sampling	
				Effort	Result
Tributary 1	- 0.25 m wide - 1-3 cm deep - steep gradient 5 m from mouth	- very shallow - steep gradient	- none	-	-
Tributary 2	- dry	- N/A	- none	-	-
Tributary 3	- dry	- N/A	- none	-	-
Tributary 4	- trickle of water falling 4 m from cliff to river	- waterfall	- none	-	-
Pincher Creek (Tributary 5)	- mouth to 1 km upstream: 7-10 m wide 2 m deep, low velocity; silt & unicellular algae; riffle/pool area 1 km upstream	- none	- none from mouth to first riffle (1 km upstream); marginal in riffle/pool area 1-2 km upstream, substrate size suitable but algae & silt covered	- boat electrofishing 411 seconds	2J[b] rainbow trout 2J mountain whitefish 1A northern pike 8J white sucker 61A white sucker 31A longnose sucker
Tributary 6	- dry	- N/A	- none	-	-
Beaver Creek (Tributary 7)	- 1-2 m wide - 5-15 cm deep at mouth - riffle/pool sequence	- very shallow riffles with significant slope; impassable slope 500 m from mouth	- marginal riffle/pool areas; substrate 20% suitable size but compacted and algae covered	-	-

continued . . .

Table 11 (concluded)

Watercourse[a]	Description	Limitations to Fish Access	Type and Size of Spawning Habitat	Sampling	
				Effort	Result
Tributaries 8, 9, 10, 11	- dry	- N/A	- none	-	-
Tributary 12	- 1 m wide; silt banks; no visible flow	- none	- none; silt channel; no visible flow	-	-
Tributaries 13, 14, 15	- dry	- N/A	- none	-	-
Tributary 16	- no flow, dry 50 m upstream	- none	- none: no flow	-	-
Tributary 17	- dry	- N/A	- none	-	-

[a] Unnamed tributaries are identified in Figure 3
[b] Life-history stages: J - Juvenile
A - Adult

redds within the study area was precluded by poor visibility; however, as no fish were located within the study area in spawning condition, no redds are anticipated to have occurred in this region of the river.

6.0 DISCUSSION

6.1 WINTER SPECIES DISBTRIBUTION, ABUNDANCE AND HABITAT UTILIZATION

6.1.1 Mountain Whitefish

Abundance of mountain whitefish, especially adults, was greatest upstream of LNID during the winter inventory. Within these two segments (5 and 6), suitable Habitat Areas which supported significant numbers and concentrations of fish included pools, riffles and runs (Table 6) and encompassed a wide variety of depths, velocities and substrates. Both adult and juvenile mountain whitefish were present in each Habitat Area and there was no apparent preference for a particular habitat category by either life stage. Of the three habitat categories, runs provided a greater number of Habitat Areas than either riffles or pools (Appendix I, Table 7).

Downstream of LNID, juvenile mountain whitefish were still abundant to Rocky Coulee (Segment 4). Adults were significantly less abundant throughout both lower segments than upstream of LNID. In all habitat categories there were notably fewer adult mountain whitefish than juveniles, and in some Habitat Areas only juveniles were present. Runs again comprised most habitat areas, but riffles and pools appear to be of increased and decreased importance respectively. Within riffles or runs, representative and utilized habitat characteristics are comparable between segments upstream and downstream of LNID (Table 7).

Distribution of all life-history stages of mountain whitefish was similar to that found during the previous IFN study.

6.1.2 Rainbow Trout

In winter, as in summer and fall (Fernet and Matkowski 1986), adults and juveniles were the only two life-history stages of rainbow trout

present in the study area. Rainbow trout were again most common upstream of LNID, although some individuals were captured in downstream areas. CPUE statistics for March indicate greater numbers of rainbow trout adults present in the study area than in October, 1985 (Table 12).

Adult rainbow trout were found in pools, riffles and runs in Segments 5 and 6. Both of the juvenile rainbow trout captured in Habitat Areas were utilizing runs in Segment 5. Utilized habitat characteristics are similar between segments for each habitat category (e.g., riffle) (Table 8).

6.1.3 Other Sport Species

Distribution and abundance of bull trout and brown trout was similar to that found during the previous summer and fall (Fernet and Matkowski 1986). Those few individuals captured were present only in the upper segments of the study area. Lake whitefish were captured in Segments 4 and 5, and again were present in small numbers only. Northern pike were captured in all but Segment 6 of the study area. Only small numbers of northern pike were present in the river.

6.2 WINTER HABITAT CONDITIONS

Habitat conditions in the Oldman River during late February and early March were atypical in 1986. River discharge increased suddenly to rates similar to those of freshet, removing all ice cover. The event was a result of heavy snowfall and subsequent melt in late February. Field studies commenced when flows had decreased enough to allow safe working conditions; however, these flows were still unseasonably high. As a result of the high flows, visibility during early March was also unseasonably poor but increased quickly with a decrease in discharge.

TABLE 12

COMPARISON OF ADULT RAINBOW TROUT CATCH-PER-UNIT-EFFORT FROM BOAT ELECTROFISHING, OLDMAN RIVER, OCTOBER, 1985[a] and MARCH, 1986

	Rainbow Trout Catch-Per-Unit-Effort (No./100s)	
Segment	October 1985	March 1986
4	0.09	0.03
5	0.10	0.36
6	0.07	0.61

[a] from Fernet and Matkowski (1986)

6.3 SPRING SPECIES DISTRIBUTION AND ABUNDANCE

6.3.1 Mountain Whitefish

Mountain whitefish were captured throughout the mainstem study area and Pincher Creek during the spring investigation. The distribution was similar to that found during investigations in fall, 1985 (Fernet and Matkowski 1986) and winter, 1986, although fry (i.e., 1985 year class) were not captured in Segment 4 in Spring. Abundance of mountain whitefish in April differed somewhat from that in March (winter). There were a greater number of adult and juvenile mountain whitefish in Segment 6 in April than there had been in March. In Segment 5 numbers of juveniles were comparable between April and March, while numbers of adults decreased slightly from March to April. CPUE statistics for Segment 4 indicate much lower numbers of both adults and juveniles in April than in March. Seasonal variations in mountain whitefish abundance within segments are unexplained but may have involved migrations between segments for purposes such as feeding and rearing. As in previous studies, few mountain whitefish fry were captured in any segment while boat electrofishing (Fernet and Matkowski 1986). However, boat electrofishing is not a suitable means of determining distribution and abundance of fry.

6.3.2 Rainbow Trout

As determined in studies during fall of 1985 (Fernet and Matkowski 1986) and winter of 1986, rainbow trout were most common upstream of LNID during spring. Again, only adult and juvenile rainbow trout were present in the study area. Only juveniles were captured downstream of LNID during spring studies; some adults as well as juveniles had been captured in that area in March, 1986. Adult rainbow trout were notably less abundant throughout the study area in April than they had been in March. In April, juveniles were less abundant in Segment 5 but more abundant in Segment 6 than they had been in March. These distributions may have been the result of upstream migrations of adults to spawning areas above the proposed damsite, and of juveniles to upstream areas for rearing.

6.3.3 Brown and Bull Trout

As in previous studies brown and bull trout were captured only in the upstream segments of the IFN study area (Fernet and Matkowski 1986). Although numbers captured were still small, CPUE values were higher from 7 to 12 April than in March. It appears that there were increased numbers of brown and bull trout in Segments 5 and 6 in April.

6.3.4 Other Sport Species

Few lake whitefish were collected in previous investigations, all of which were adults (Fernet and Matkowski 1986). In April lake whitefish were only captured in Segment 5; in March, although a few individuals were captured in Segment 4, the majority were captured in Segment 5. Lake whitefish were also present in Pincher Creek in April; no sampling had been done in Pincher Creek during previous studies. Northern pike were present in Segment 5 but not Segment 4. This species had previously been found in both segments (Fernet and Matkowski 1986).

6.4 RAINBOW TROUT SPAWNING ACTIVITY

Rainbow trout spawning activity in the Oldman River between the proposed damsite and the Highway 2 bridge appears to be absent or negligible. Although Segments 5 and 6 contained substrate of suitable size, no evidence of spawning (e.g., redds) was found. Boat electrofishing CPUE results indicate fewer adult rainbow trout present in the study area in April than in late winter. On April 22, 1986, when spawning was taking place upstream of the study area in the Crowsnest River (J. O'Neil, pers. comm.), rainbow trout downstream of the proposed damsite were not yet close to spawning. Water temperatures in the two areas were comparable. It appears likely that most adult rainbow trout which were downstream of the proposed damsite during winter migrated upstream to spawning areas above the damsite in spring. Those individuals which remained downstream of the

damsite when sampling occurred in April may have been in the process of moving upstream to spawning areas.

Most tributaries to the Oldman River downstream of the proposed damsite do not provide suitable spawning habitat for rainbow trout. Beaver Creek offers only marginal habitat with a high probability of low or intermittent flow during the incubation period. In Pincher Creek, no suitable spawning habitat is present from the mouth to a distance of approximately 1 km upstream. Upstream of this slow silty section, Pincher Creek becomes more suitable for spawning use, with riffle pool sequences. Substrate in some riffles is of suitable size but is often covered with silt or algae. Pincher Creek provides the most likey spawning habitat of all tributaries examined, but no evidence of rainbow trout spawning activity was found.

6.5 SEASONAL SPECIES DISTRIBUTION, ABUNDANCE AND HABITAT UTILIZATION

6.5.1 Mountain Whitefish

Mountain whitefish were present in the Oldman River from the proposed damsite downstream to the spillpool below the Lethbridge Weir in summer, 1985 (Fernet and Matkowski 1986). Adults and juveniles were most abundant upstream of LNID and decreased in abundance with increased distance downstream. Habitat upstream of LNID was more suitable for mountain whitefish than that downstream, having cooler water temperatures and greater flows. Mountain whitefish fry were most abundant in Segment 4 where preferred habitat (shallow riffle-run areas and small side channels) was common. Numbers of fry decreased with distance upstream possibly because of increased water velocities, and with distance downstream possibly due to low streamflow and high water temperatures (Fernet and Matkowski 1986).

Fall migrations by adult and juvenile mountain whitefish occur in the Oldman River. Patterns of migration up or downstream appear to depend

upon river flow conditions (Fernet and Matkowski 1986). The fish congregate primarily in areas upstream of LNID in September and October. Spawning occurs from the proposed damsite down to the Highway 2 crossing (Segments 5, 6 and part of 4) from late September to mid-October depending upon water temperatures. Segments 5 and 6 contain the greatest amount of spawning habitat, which is extensively used (Fernet and Matkowski 1986).

After spawning, adults and juveniles migrate to overwintering areas. Winter studies indicate that as in summer and fall, adult and juvenile mountain whitefish are most abundant upstream of LNID and decrease with increased distance downstream. Adult mountain whitefish overwintered primarily in the upper two segments of the study area while juveniles overwintered in the upper three segments. Mountain whitefish fry appear to have a similar distribution in the summer, fall and winter.

In spring, adult and juvenile mountain whitefish were still abundant in Segments 5 and 6 but not in Segment 4. Abundance of adults and juveniles had increased in the area immediately downstream of the damsite (Segment 6). It appears that adults and juveniles migrate upstream in the river in spring, likely to feed.

The Oldman River from the proposed damsite downstream to Rocky Coulee is utilized by mountain whitefish adults, juveniles and fry during all seasons. This area also includes important habitat for spring and fall migrations of adults and juveniles. Upstream of LNID the river contains important mountain whitefish spawning habitat.

6.5.2 Rainbow Trout

Rainbow trout adults and juveniles are the only two life-history stages of this species found downstream of the Oldman River damsite. Adult and juvenile rainbow trout were most common upstream of LNID, and occasionally occurred downstream as far as the town of Fort Macleod during winter and spring of 1986, and summer and fall of 1985 (Fernet and Matkowski

1986). Habitat for this species appears to be most suitable upstream of LNID, having greater flows and cooler summer water temperatures than downstream areas (Fernet and Matkowski 1986).

Adult and juvenile rainbow trout utilized the Oldman River downstream of the proposed damsite in all seasons. Increased CPUE for adults upstream of LNID during fall (Fernet and Matkowski 1986) and winter indicates a possible downstream migration past the proposed damsite to overwintering areas below. Decreased CPUE for adults in spring indicates possible upstream migration of adults to areas above the proposed damsite. The CPUE for juveniles increased immediately downstream of the proposed damsite (Segment 6) and decreased further downstream (Segment 5) during the spring, indicating an upstream movement possibly to summer rearing areas. The area from the proposed damsite down to Segment 5 may include important habitat for spring and fall migration and overwintering of adults, as well as spring rearing by juveniles.

Spawning by rainbow trout does not appear to occur in the Oldman River downstream of the proposed damsite. No fry have been located during winter, spring or previous studies (Fernet and Matkowski 1986). No ripe fish were encountered and no spawning redds were identified during spawning studies.

6.5.3 Other Sport Species

Cutthroat trout, brown trout and bull trout rarely occur in the study area, and only upstream of Fort Macleod. The CPUE for brown and bull trout was slightly greater during the spring studies than in previous winter, and fall and summer studies (Fernet and Matkowski 1986). It is possible that some brown and bull trout which occupy habitat upstream of the proposed damsite at other times of the year migrate downstream in the spring. These fishes may be displaced from upstream habitat during this season by spawning rainbow trout, or they may migrate downstream to feed.

At all times of the year only small numbers of adult lake whitefish utilize the Oldman River downstream of the proposed damsite; no juveniles or fry have been captured. A few adult and juvenile northern pike were present in the study area during all seasons. Summer and fall studies indicate that pike are most common downstream of Fort Macleod where rearing and overwintering habitat are most abundant (Fernet and Matkowski 1986).

7.0 LITERATURE CITED

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8.0 PERSONAL COMMUNICATIONS

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APPENDIX I
TABLE 1

RECORD OF WATER TEMPERATURES DURING WINTER SAMPLING,
OLDMAN RIVER, 1986

Date	Segment	Time	Water Temperature (°C)
Mar 1	6	1005	0.0
Mar 2	6	0912	1.0
Mar 5	5	0840	1.5
Mar 5	5	1730	3.5
Mar 6	5	0850	0.5
Mar 7	5	0905	0.0
Mar 8	5	0820	1.5
Mar 9	4	0940	2.5
Mar 9	4	1810	4.0
Mar 10	4	0930	2.5
Mar 10	4	1830	4.5
Mar 13	4	1100	4.5
Mar 13	3	1700	6.5
Mar 14	3	1520	6.0
Mar 15	3	0845	4.0
Mar 16	4	0910	3.0

APPENDIX I
TABLE 2

COMMON AND SCIENTIFIC NAMES OF FISH SPECIES[a] CAPTURED,
OLDMAN RIVER, WINTER, SPRING, 1986

Common Name	Scientific Name
lake whitefish	Coregonus clupeaformis (Mitchill)
mountain whitefish	Prosopium williamsoni (Girard)
rainbow trout	Salmo gairdneri Richardson
bull trout	Salvelinus confluentus (Suckley)
brown trout	Salmo trutta Linnaeus
northern Pike	Esox lucius Linnaeus
longnose dace	Rhinichthys cataractae (Valenciennes)
longnose sucker	Catostomus catostomus (Forster)
white sucker	Catostomus commersoni (Lacepede)
mountain sucker	Catostomus platyrhynchus (Cope)
shorthead redhorse	Moxostoma macrolepidotum (Lesueur)
trout-perch	Percopsis omiscomaycus (Walbaum)
burbot	Lota lota (Linnaeus)
spoonhead sculpin	Cottus ricei (Nelson)

[a] Nomenclature according to American Fisheries Society (1980).

APPENDIX I
TABLE 3

RECORD OF WATER TEMPERATURES DURING SPRING SAMPLING,
OLDMAN RIVER, 1986

Date	Segment	Time	Water Temperature (°C)
Apr 8	6	1051	6.0
Apr 8	5	1720	9.0
Apr 9	5	1000	7.0
Apr 9	6	1640	10.5
Apr 10	Pincher Ck	1057	8.0
Apr 10	Beaver Ck	1550	9.5
Apr 11	5	0945	4.0
Apr 12	4	1120	1.0
Apr 22	6	1350	12.0
Apr 22	5	1800	12.0
Apr 23	6	0900	4.0[a]
Apr 24	6	1144	4.0[a]

[a] Decreased temperatures due to snowfall.

APPENDIX I
TABLE 4

BOAT ELECTROFISHING RECORD, OLDMAN RIVER STUDY AREA, MARCH, 1986

Date	Segment	Location (River kilometre)[a]	Effort (s)	CATCH (Total No. of Individuals) Catch-per-unit-effort (No./100s)										
				Lake Whitefish	Mountain Whitefish			Rainbow Trout		Brown Trout	Bull Trout	Northern Pike		Longnose Sucker
				Ad[b]	F	Juv	Ad	Juv	Ad	Ad	Ad	Juv	Ad	Ad
Mar 1	5	308.6-308.7	242			(8) 3.31	(6) 2.48							(1)0.41
Mar 1	5	308.0-308.8	1078			(53) 4.92	(101) 9.37							
Mar 1	6	314.5-316.0	391			(55)14.07	(58)14.83		(1)0.26		(1) 0.26			(20)5.11
Mar 1	6	312.4-314.5	956			(35) 3.66	(37) 3.87	(1)0.10	(4)0.42					(5)0.52
Mar 2	6	310.6-312.4	280			(10) 3.57	(11) 3.93		(5)1.79	(1)0.36				(3)1.07
Mar 2	5	308.6-310.6	819			(58) 7.08	(100)12.21		(6)0.73					(30)3.66
Mar 5	5	300.9-304.6	2144			(237)11.05	(134) 6.25	(6)0.28	(13)0.28					(24)1.12
Mar 6	5	306.3-308.6	1137			(78) 6.86	(63) 5.54	(3)0.26	(3)2.64	(1)0.09				(12)1.05
Mar 6	5	304.6-306.3	1613	(3)0.19	(2)0.12	(122) 7.56	(86) 5.33	(1)0.06	(1)0.06					(12)0.74
Mar 7	5	278.0-300.9	7232	(11)0.15		(581) 8.03	(571) 7.89	(16)0.22	(28)0.39			(1) 0.01	(8)0.11	(153)2.12
Mar 9	4	255.5-278.0	6107	(1)0.02		(202) 3.31	(100) 1.64	(3)0.05	(4)0.06					(34)0.56
Mar 9	4	247.5-255.5	1511			(130) 8.60	(6) 0.40	(2)0.13						(2)0.13
Mar 11	4	224.7-247.5	5488		(2)0.04	(396) 7.22	(303) 5.52						(1)0.02	(37)0.67
Mar 13	4	222.7-224.7	544		(1)0.18	(35) 6.43	(7) 1.29							(5)0.92
Mar 13	3	198.5-222.7	6217		(4)0.06	(136) 2.19	(128) 2.06	(1)0.02					(1)0.02	(34)0.55
TOTAL			35759	(15)0.04	(9)0.02	(2136) 5.97	(1711) 4.78	(33)0.09	(65)0.18	(2)0.01	(1)<0.01	(1)<0.01	(10)0.03	(372)1.05

continued . . .

Appendix I, Table 4 (concluded)

Date	Segment	Location (River kilometre[a])	Effort (s)	CATCH (Total No. of Individuals) Catch-per-unit-effort (No./100s) White Sucker Juv	White Sucker Ad	Mountain Sucker Ad	Shorthead Redhorse Ad	Burbot Ad	Spoonhead Sculpin Ad	Unknown Ad	TOTAL
Mar 1	5	308.6-308.7	242								(15) 6.20
Mar 1	5	308.0-308.8	1078								(154)14.29
Mar 1	6	314.5-316.0	391						(1) 0.26		(136)34.78
Mar 1	6	312.4-314.5	956			(1)0.10					(83) 8.68
Mar 2	6	310.6-312.4	280			(1)0.36					(31)11.07
Mar 2	5	308.6-310.6	819								(194)23.69
Mar 5	5	300.9-304.6	2144		(14)0.65			(1)0.05		(50)2.33	(479)22.34
Mar 6	5	306.3-308.6	1137		(1)0.09						(161)14.16
Mar 6	5	304.6-306.3	1613		(24)1.49						(251)15.56
Mar 7	5	278.0-300.9	7232		(117)1.62						(1486)20.55
Mar 9	4	255.5-278.0	6107		(39)0.64						(383)6.27
Mar 9	4	247.5-255.5	1511		(6)0.40			(1)0.07			(147)9.73
Mar 11	4	224.7-247.5	5488		(64)1.17		(7)0.13				(810)14.76
Mar 13	4	222.7-224.7	544	(2)0.37	(2)0.37		(1)0.18				(53) 9.74
Mar 13	3	198.5-222.7	6217		(32)0.51		(3)0.05	(1)0.02			(340) 5.47
TOTAL			35759	(2)0.01	(299)0.84	(2)0.01	(11)0.03	(3)0.01	(1)<0.01	(50)0.14	(4723)13.21

[a] Distance in kilometres from the Grand Forks.

[b] Life history stages: F = Fry; Juv = Juvenile; Ad = Adult

APPENDIX I
TABLE 5

BACKPACK ELECTROFISHING RECORD, OLDMAN RIVER STUDY AREA, MARCH, 1986

Date	Segment	Location (River Kilometre)[a]	Effort (s)	CATCH (Total No. of individuals) Catch-per-unit-effort (No./100s)										
				Mountain Whitefish F[b]	Mountain Whitefish Juv	Longnose Dace Juv	Longnose Dace Ad	Mountain Sucker Juv	Mountain Sucker Ad	Trout Perch Juv	Trout Perch Ad	Burbot Juv	Unidentified Cyprinidae	TOTAL
Mar 8	5	310.7-311.0	407		(5)1.23			(1)0.25			(2)0.49			(8) 1.97
Mar 8	5	308.5-308.9	1156	(1)0.09	(73)6.31	(9)0.78	(14)1.21	(9)0.78	(2)0.17	(3)0.26	(7)0.60	(1)0.09	(2)0.07	(121)10.47
TOTAL			1563	(1)0.06	(78)4.99	(9)0.58	(14)0.90	(10)0.64	(2)0.13	(3)0.19	(9)0.58	(1)0.06	(2)0.13	(129) 8.25

[a] Distance in kilometers from the Grand Forks.
[b] Life history stages: F = Fry; Juv = Juvenile; Ad = Adult.

APPENDIX I
TABLE 6

BOAT ELECTROFISHING RECORD, OLDMAN RIVER STUDY AREA, APRIL 8-12, 1986

CATCH
(Number of Individuals) Catch-per-unit-effort (no./100s)

Date	Seg-ment	Location (River Kilometre)[a]	Effort (s)	Lake Whitefish Ad[b]	Mountain Whitefish F	Mountain Whitefish Juv	Mountain Whitefish Ad	Rainbow Trout Juv	Rainbow Trout Ad	Brown Trout Juv	Brown Trout Ad	Bull Trout Juv	Bull Trout Ad
Apr 8	6	313.0-316.0	819			(171)20.88	(127)15.51	(3)0.37	(1)0.12		(1)0.12		
Apr 8	6	313.0-316.0	771			(54) 7.00[c]	(41) 5.32[c]	(2)0.26	(1)0.13	(1)0.13			(1)0.13
Apr 8	6	313.0-314.5	345			(19) 5.51[c]	(14) 4.06[c]	(1)0.29	(1)0.29				
Apr 8	6	312.4-313.0	214		(2)9.35	(19) 8.88	(17) 7.94						
Apr 8	6	310.6-312.4	618			(46) 7.44	(36) 5.83	(2)0.32	(1)0.16		(2)0.32		(1)0.16
Apr 8	5	308.6-310.6	836		(3)0.36	(125)14.95	(58) 6.94						(1)0.12
Apr 8	5	308.6-310.6	672		(2)2.98	(112)16.67	(32) 4.76		(2)0.30				
Apr 9	5	296.0-308.6	3966	(1)0.03		(291) 7.34	(221) 5.57	(6)0.15	(6)0.15		(4)0.10		
Apr 10	Pincher Ck mouth-upstream 1 km		411	(1)0.24		(2) 0.49		(4)0.97					
Apr 10	5	287.0-296.0	3617	(1)0.03		(304) 8.41	(286) 7.91	(4)0.11	(5)0.14			(1)0.03	
Apr 11	5	278.0-287.0	2919		(1)0.03	(62) 2.12	(51) 1.75		(3)0.10				
Apr 12	4	255.5-278.0	5331			(51) 0.96	(23) 0.43	(2)0.04					
Apr 22	6	310.6-316.0	1191			(67) 5.62	(26) 2.18	(1)0.08					
Apr 22	5	301.0-310.6	2826		(1)0.04	(161) 5.70	(52) 1.84	(9)0.32	(3)0.11		(2)0.07		
Apr 23	Pincher Ck mouth - upstream 1 km		351	(2)0.57		(11) 3.13							
Apr 23	5	278.0-310.0	8093	(5)0.06	(4)0.05	(123) 1.52	(61) 0.75	(1)0.01	(2)0.03				(1)0.01
Apr 24	6	310.6-316.0	1039		(1)0.10	(18) 1.73	(5) 0.48						
Apr 24	5	308.6-310.6	591			(21) 3.55	(4) 0.68	(1)0.17					
TOTAL			34610	(10)0.03	(14)0.04	(1657) 4.79	(1054) 3.05	(36)0.10	(25)0.07	(1)<0.01	(9)0.03	(1)<0.01	(4)0.01

continued . . .

Appendix I, Table 6 (concluded)

Date	Segment	Location (River Kilometre)[a]	Effort (s)	CATCH (Number of Individuals) Catch-per-unit-effort (no./100s)								
				Unidentified Trout		Northern Pike		Longnose Sucker	White Sucker		Burbot	TOTAL
				Juv	Ad	Juv	Ad	Ad	Juv	Ad	Ad	
Apr 8	6	313.0-316.0	819					(58)7.08		(52) 6.35		(413)50.43
Apr 8	6	313.0-316.0	771					(15)1.95		(8) 1.04	(1)0.13	(124)16.08[c]
Apr 8	6	313.0-314.5	345					(8)2.32				(43)12.46[c]
Apr 8	6	312.4-313.0	214					(2)9.35		(2) 9.35		(42)19.63
Apr 8	6	310.6-312.4	618	(1)0.16				(61)9.87		(14) 2.27		(164)26.54
Apr 8	5	308.6-310.6	836		(1)0.12			(63)7.54		(20) 2.39		(271)32.42
Apr 8	5	308.6-310.6	672					(6)0.89		(1) 0.15		(155)23.07
Apr 9	5	296.0-308.6	3966					(48)1.21	(19)0.48	(106) 2.67		(702)17.70
Apr 10	Pincher Ck mouth-upstream 1 km		411				(1)0.24	(31)7.54		(61)14.84		(100)24.33
Apr 10	5	287.0-296.0	3617				(1)0.08	(45)1.24	(4)0.11	(22) 0.61		(673)18.61
Apr 11	5	278.0-287.0	2919			(1)0.03		(14)0.48	(9)0.31	(50) 1.71		(191) 6.54
Apr 12	4	255.5-278.0	5331					(15)0.28		(18) 0.34		(109) 2.05
Apr 22	6	310.6-316.0	1191					(17)1.43		(2) 0.17		(113) 9.49
Apr 22	5	301.0-310.6	2826				(1)0.04	(28)0.99	(1)0.04	(6) 0.21	(4)0.14	(268) 9.48
Apr 23	Pincher Ck mouth-upstream 1 km		351					(7)3.51		(2) 0.57		(22) 6.27
Apr 23	5	278.0-310.0	8093				(4)0.05	(43)0.53	(26)0.32	(75) 0.93	(1)0.01	(346) 4.23
Apr 24	6	310.6-316.0	1039					(17)1.64	(2)0.19	(2) 0.19		(45) 4.33
Apr 24	5	308.6-310.6	591					(10)1.69		(2) 0.34		(38) 6.43
TOTAL			34610	(1)<0.01	(1)<0.01	(1)<0.01	(7)0.02	(488)1.41	(61)0.18	(443) 1.28	(6)0.02	(3819)11.03

[a] Distance in kilometres from the Grand Forks

[b] Life-history stages: F-fry, J-juvenile, A-adult

[c] Low catch likely due to shocking immediately prior in same location.

APPENDIX I
TABLE 7

SUMMARY OF INFORMATION REGARDING RADIO TAGGING OF RAINBOW TROUT IN THE OLDMAN RIVER STUDY AREA, MARCH AND APRIL, 1986

Fish				Radio Tag		
Date Tagged	Fish Number	Fork Length (mm)	Point of Release	Transmitter Number	Transmitter Frequency (MHz)	Pulse Rate (ppm)
Mar 8/86	71	530	km 314	962	150.969	100
Mar 5/86	127	528	km 302	937	150.950	80
Apr 10/86	130	603	km 295	337	151.351	85

APPENDIX I
TABLE 8

RECORD OF GILL NET SAMPLING IN THE OLDMAN RIVER STUDY AREA, MARCH, 1986

Gill Net Stn	Segment	Location (River Kilometre)[a]	Date	Mesh Size[b] (cm)	Duration of Set (h)	CATCH (Total No. of individuals) Catch per unit effort (No./h)								
						Mountain Juv[c]	Whitefish Ad	Rainbow Trout Ad	Bull Trout Ad	Northern Pike Ad	Longnose Juv	Sucker Ad	White Sucker Juv	TOTAL
GN1	6	315.0	Mar 2	7.6	15.42			(1)0.06	(1)0.01			(1)0.06		(3)0.19
GN2	6	312.5	Mar 2	6.4	15.52		(2)0.13	(1)0.06			(1)0.06	(5)0.32	(2)0.13	(11)0.71
GN3	6	311.0	Mar 2	7.6	15.75									(0)0.00
GN4	3	205.0	Mar 14	7.6	17.42		(1)0.06							(1)0.06
GN5	3	205.0	Mar 14	7.6	17.50					(1)0.06				(1)0.06
GN6	4	229.0	Mar 15	7.6	16.95		(1)0.06							(1)0.06
GN7	4	229.0	Mar 15	7.6	17.03	(1)0.06								(1)0.06
GN8	4	226.5	Mar 15	6.4	16.67									(0)0.00
TOTAL					132.26	(1)0.01	(4)0.03	(2)0.01	(1)0.01	(1)0.01	(1)0.01	(6)0.04	(2)0.01	(18)0.14

[a] Distance in kilometers from the Grand Forks.
[b] All gill nets were 15.2 meters in length x 2.4 meters in depth.
[c] Life history stages: Juv = Juvenile; Ad = Adult.

APPENDIX I
TABLE 9

SUMMARY OF FISH TAGGED DURING WINTER SAMPLING, OLDMAN RIVER STUDY AREA, 1986

Segment	Rainbow Trout	Bull Trout	Mountain Whitefish	Lake Whitefish	Northern Pike	TOTAL
3			16			16
4	3		64			67
5	22		110	6	2	140
6	1	1	23			25
TOTAL	26	1	213	6	2	248

APPENDIX I
TABLE 10

SUMMARY OF FISH TAGGED DURING SPRING SAMPLING, OLDMAN RIVER STUDY AREA, 1986

Location	Mountain Whitefish	Lake Whitefish	Rainbow Trout	Brown Trout	Bull Trout	TOTAL
Segment 4	4					4
Segment 5	144	3	10	2	1	160
Segment 6	22			4	1	27
Pincher Ck		2				2
TOTAL	170	5	10	6	2	193

APPENDIX I
TABLE 11

SUMMARY OF INFORMATION REGARDING FISH COLLECTED FOR MERCURY ANALYSES, OLDMAN RIVER, SPRING, 1986

Species	Capture Date	Capture Location		Fork Length (mm)	Weight (g)	Sex
		Segment	Kilometre[a]			
mountain whitefish	Apr 11	5	310	293	318	un
mountain whitefish	11	5	279	279	273	un
mountain whitefish	11	5	279	309	366	un
mountain whitefish	11	5	310	310	326	un
mountain whitefish	11	5	310	325	425	un
mountain whitefish	11	5	279	370	548	un
mountain whitefish	11	5	283	371	538	un
mountain whitefish	11	5	310	-	569[b]	un
mountain whitefish	11	5	283	396	712	un
mountain whitefish	11	5	279	413	665	un
rainbow trout	11	5	279	319	373	un
rainbow trout	11	5	310	-	600[b]	un
rainbow trout	11	5	283	396	675	un
rainbow trout	22	6	312	343	600	F
rainbow trout	22	5	306	375	750	F
rainbow trout	22	5	306	385	875	F
rainbow trout	23	5	292	314	490	un
white sucker	22	5	307	408	1220	F
white sucker	22	5	306	443	1320	F
white sucker	23	5	289	404	1175	F
white sucker	23	5	283	415	1375	F
white sucker	23	5	283	417	1405	F
white sucker	23	5	284	424	1352	F
white sucker	23	5	283	428	1445	F
white sucker	23	5	283	444	1743	F
white sucker	23	5	284	448	1547	F
white sucker	23	5	283	461	1743	F
longnose sucker	22	5	307	393	825	M
longnose sucker	22	5	307	400	847	M
longnose sucker	22	5	301	404	750	un
longnose sucker	22	5	307	404	992	M
longnose sucker	22	6	312	413	1025	F
longnose sucker	22	5	307	425	1025	M
longnose sucker	22	5	307	425	1095	F
longnose sucker	22	6	312	456	1550	F
longnose sucker	23	5	292	389	890	un
longnose sucker	23	5	292	444	1371	un

[a] Distance in kilometres upstream of the Grand Forks.
[b] Partial weight.

APPENDIX I
TABLE 12

LIST OF FISH HABITAT AREAS IN THE OLDMAN RIVER STUDY AREA, WINTER, 1986

Habitat Area No.	Segment	Habitat Category	Species Present	Area (m^2)	Habitat Parameters Measured (Yes/No)
1	6	Run	mountain whitefish-A,J[a];	10,080.0	Yes
2	6	Riffle	mountain whitefish-A,J; bull trout-A	4,664.0	Yes
3	6	Pool	mountain whitefish-A,J; rainbow trout-A	1,519.0	Yes
4	6	Run	mountain whitefish-A,J; rainbow trout-A	12,906.0	Yes
5	6	Riffle	mountain whitefish-A,J; rainbow trout-A	4,808.1	Yes
6	6	Pool	mountain whitefish-A,J;	512.4	Yes
7	5	Riffle	mountain whitefish-A,J; rainbow trout-A	7,088.9	Yes
8	5	Run	mountain whitefish-A,J; rainbow trout-A	11,576.7	Yes
9	5	Run	mountain whitefish-A,J;	12,000.0	Yes
10	5	Pool	mountain whitefish-A,J;	4,560.0	Yes
11	5	Run	mountain whitefish-A,J; rainbow trout-J	13,860.0	Yes
12	5	Run	mountain whitefish-A,J;	4,903.5	Yes
13	5	Pool	mountain whitefish-A,J; rainbow trout-A	3,962.5	Yes
14	5	Run	mountain whitefish-A,J;	4,851.0	Yes
15	5	Pool	mountain whitefish-A,J; rainbow trout-A	798.0	Yes
16	5	Run	mountain whitefish-A,J;	10,830.0	No
17	5	Run	mountain whitefish-A,J;	8,930.0	No
18	5	Pool	mountain whitefish-A,J;	823.0	No
19	5	Pool	mountain whitefish-A,J; brown trout-A	887.0	No
20	5	Pool	mountain whitefish-A,J; lake whitefish-A	919.0	No
21	5	Run	mountain whitefish-A,J; rainbow trout-A,J	6,000.0	No
22	5	Run	mountain whitefish-A,J;	9,050.0	No
23	5	Run	mountain whitefish-A,J;	4,800.0	No
24	5	Run	mountain whitefish-A,J;	6,351.0	No
25	5	Run	mountain whitefish-A,J;	1,500.0	No
26	5	Run	mountain whitefish-A,J;	5982.0	No
27	5	Pool	mountain whitefish-A,J; lake whitefish-A	1,250.0	No
28	5	Run	mountain whitefish-A,J;	8,400.0	No
29	5	Run	mountain whitefish-A,J;	6,600.0	No

continued . . .

Appendix I, Table 12 (continued)

Habitat Area No.	Segment	Habitat Category	Species Present	Area (m^2)	Habitat Parameters Measured (Yes/No)
30	5	Pool	mountain whitefish-A,J; lake whitefish-A; northern pike-A	896.0	No
31	5	Run	mountain whitefish-A,J	9,200.0	No
32	5	Riffle	mountain whitefish-A,J	8184.0	Yes
33	5	Run	mountain whitefish-A,J	8989.0	No
34	5	Run	mountain whitefish-A,J; rainbow trout-A	11160.0	Yes
35	4	Run	mountain whitefish-A,J	3300.0	No
36	4	Run	mountain whitefish-A,J	13680.0	Yes
37	4	Run	mountain whitefish-A,J	23370.0	Yes
38	4	Run	mountain whitefish-J	2786.0	No
39	4	Run	mountain whitefish-A,J	36900.0	Yes
40	4	Run	mountain whitefish-J	5238.0	Yes
41	4	Riffle	mountain whitefish-A,J	11421.0	Yes
42	4	Pool	mountain whitefish-A,J	654.0	No
43	4	Riffle	mountain whitefish-A,J	4000.0	No
44	4	Run	mountain whitefish-A,J	7000.0	No
45	4	Run	mountain whitefish-A,J	20250.0	No
46	4	Run	mountain whitefish-A,J	9000.0	No
47	4	Run	mountain whitefish-A,J	23472.0	Yes
48	4	Riffle	mountain whitefish-A,J	11122.0	Yes
49	4	Run	mountain whitefish-A,J	88110.0	Yes
50	4	Riffle	mountain whitefish-A,J	9955.0	Yes
51	4	Run	mountain whitefish-A,J	27666.0	Yes
52	3	Riffle	mountain whitefish-A,J	31496.0	Yes
53	3	Riffle	mountain whitefish-A,J	14453.0	Yes
54	3	Run	mountain whitefish-A,J	7500.0	No
55	3	Riffle	mountain whitefish-A,J	10340.0	Yes
Sub-totals	6	Pool - 2	mountain whitefish-A,J; rainbow trout-A	20314.0	
		Run - 2	mountain whitefish-A,J; rainbow trout-A	22986.0	
		Riffle - 2	mountain whitefish-A,J; rainbow trout-A; bull trout-A	9472.1	

continued . . .

Appendix I, Table 12 (concluded)

Habitat Area No.	Segment	Habitat Category	Species Present	Area (m^2)	Habitat Parameter Measured (Yes/No)
	5	Pool - 8	mountain whitefish-A,J; rainbow trout-A; brown trout-A lake whitefish-A, northern pike-A	14095.5	
		Run - 18	mountain whitefish-A,J; rainbow trout-A,J	144,983.2	
		Riffle - 2	mountain whitefish-A,J; rainbow trout-A	15272.9	
	4	Pool - 1	mountain whitefish-A,J	654.0	
		Run - 11	mountain whitefish-A,J	257,986.0	
		Riffle - 5	mountain whitefish-A,J	39284.0	
	3	Run - 1	mountain whitefish-A,J	7500.0	
		Riffle - 3	mountain whitefish-A,J	56280.0	
TOTAL		Pool - 11	mountain whitefish-A,J; rainbow trout-A; brown trout-A lake whitefish-A, northern pike-A		
		Run - 31	mountain whitefish-A,J, rainbow trout-A,J	570,554.1	
		Riffle - 9	mountain whitefish-A,J; rainbow trout-A; bull trout-A		

[a] Life History Stages: J = Juvenile; A = Adult

APPENDIX II

LIST OF CODES USED ON HABITAT LOCATION RECORDS

Substrate Categories:	Si - Silt Sa - Sand G - Gravel C - Cobble B - Boulder Bed - Bedrock
Substrate Sizes:	S - small M - medium L - large
Life History Stages:	F - Fry J - Juvenile A - Adult

HABITAT LOCATION RECORD

Habitat Location Number: 1
Category: Run
Location: Seg 6 - 314.7 km
Species Present: mountain whitefish-A,J

Mean Length (m): 126.0
Mean Width (m): 80.0
Area (m^2): 10 080.0
Maximum Depth (m): 2.00
Mean Depth: (m): 1.25
Canopy Cover (%): 0
Substrate Compaction: Compact

Transect Characteristics

Transect Number	Depth (m) 1/3 width	2/3 width
1	0.60	0.80
2	1.04	1.24
3	1.80	1.25

Representative Transect Characteristics

Transect Number 2	Depth (m)	Velocity (m/s) .8d	.6d	.2d	Substrate (%)	Cover (%)
1/3 width	1.04	0.683	0.855[a]	1.027	LG5, SC5, LC20, SB50, LB20	F40, J30, A20
2/3 width	1.24	0.902	1.028[a]	1.155	LG5, SC5, LC20, SB50, LB20	F40, J30, A20

Habitat Characteristics at Fish Capture Locations

Point Number	Depth (m)	Velocity (m/s) .8d	.6d	.2d	Substrate (%)	Cover (%)
1	1.44	0.449	0.651[a]	0.852	LG5, SC5, LC20, SB50, LB20	F40, J30, A20
2	0.96	0.571	0.771[a]	0.972	SC20, LC30, SB20, LB30	F30, J15, A15

[a] Calculated as the mean of measurements at 0.8 and 0.2 of depth.

HABITAT LOCATION RECORD

Habitat Location Number: 2
Category: Riffle
Location: Seg 6 - 314.5 km
Species Present: mountain whitefish-A,J
bull trout-A

Mean Length (m): 80.0
Mean Width (m): 58.3
Area (m^2): 4 664.0
Maximum Depth (m): 2.10
Mean Depth: (m): 1.38
Canopy Cover (%): 0
Substrate Compaction: Loose

Transect Characteristics

Transect Number	Depth (m) 1/3 width	2/3 width
1	1.25	1.20
2	1.80	0.90
3	1.75	0.70

Representative Transect Characteristics

Transect Number 2	Depth (m)	Velocity (m/s) .8d	.6d	.2d	Substrate (%)	Cover (%)
1/3 width	1.04	1.157	1.446[a]	1.734	MG5, LG10, SC50, LC35	F30, J10, A5
2/3 width	1.24	1.357	1.449[a]	1.541	MG5, LG10, SC50, LC35	F30, J10, A5

Habitat Characteristics at Fish Capture Locations

Point Number	Depth (m)	Velocity (m/s) .8d	.6d	.2d	Substrate (%)	Cover (%)
1	1.00	1.541	1.761[a]	1.982	LG10, SC60, LC30	F30, J20, A10
2	0.69		0.758		MG5, LG10, SC50, LC35	F30, J10, A5
3	0.63		0.595		MG5, LG10, SC35, LC50	F50, J30, A10

a Calculated as the mean of measurements a 0.8 and 0.2 of depth.

HABITAT LOCATION RECORD

Habitat Location Number: 3
Category: Pool
Location: Seg 6 - 314.4 km
Species Present: mountain whitefish-A,J
rainbow trout-A

Mean Length (m): 70.0
Mean Width (m): 21.7
Area (m^2): 1519.0
Maximum Depth (m): 1.25
Mean Depth: (m): 0.98
Canopy Cover (%): 0
Substrate Compaction: Compact

Transect Characteristics

Transect Number	Depth (m) 1/3 width	2/3 width
1	0.55	0.65
2	1.24	1.20
3	0.95	1.05

Representative Transect Characteristics

Transect Number 2	Depth (m)	Velocity (m/s) .8d	.6d	.2d	Substrate (%)	Cover (%)
1/3 width	1.24	0.077	0.115[a]	0.154	Silt 100	0
2/3 width	1.20	0.211	0.278[a]	0.346	Silt 100	0

Habitat Characteristics at Fish Capture Locations

Point Number	Depth (m)	Velocity (m/s) .8d	.6d	.2d	Substrate (%)	Cover (%)
*1	1.24	0.077	0.116[a]	0.154	Silt 100	0
*2	1.20	0.211	0.278[a]	0.346	Silt 100	0

[a] Calculated as the mean of measurements of 0.8 and 0.2 of depth.

HABITAT LOCATION RECORD

Habitat Location Number: 4
Category: Run
Location: Seg 6 - 314.3 km
Species Present: mountain whitefish-A,J
rainbow trout-A

Mean Length (m): 180.0
Mean Width (m): 71.7
Area (m^2): 12906.0
Maximum Depth (m): 1.50
Mean Depth: (m): 0.94
Canopy Cover (%): 0
Substrate Compaction: Compact

Transect Characteristics

Transect Number	Depth (m) 1/3 width	2/3 width
1	0.35	1.40
2	0.75	0.78
3	0.60	1.20

Representative Transect Characteristics

Transect Number 2	Depth (m)	Velocity (m/s) .8d	.6d	.2d	Substrate (%)	Cover (%)
1/3 width	0.75	0.651	0.823[a]	.996	SG5, MG10, LC20, SC50, LC15	F15, J5, A2
2/3 width	0.78	1.088	1.391[a]	1.694	SG10, MG10, LG30, SC35, LC15	F10, J5, A2

Habitat Characteristics at Fish Capture Locations

Point Number	Depth (m)	Velocity (m/s) .8d	.6d	.2d	Substrate (%)	Cover (%)
1	0.60		0.246		SI40, SG2, MG3, LG20, SC25, LC10	F10, J5
2	0.80	0.831	1.094[a]	1.357	MG5, LG30, SC20, LC40, SB5	F30, J20, A10

[a] Calculated as the mean of measurements at 0.8 and 0.2 of depth.

HABITAT LOCATION RECORD

Habitat Location Number: 5
Category: Riffle
Location: Seg 6 - 312.5 km
Species Present: mountain whitefish-A,J
rainbow trout-A

Mean Length (m): 93.0
Mean Width (m): 51.7
Area (m^2): 4808.1
Maximum Depth (m): 1.75
Mean Depth: (m): 1.23
Canopy Cover (%): 0
Substrate Compaction: Loose

Transect Characteristics

Transect Number	Depth (m) 1/3 width	2/3 width
1	0.60	1.10
2	1.50	0.90
3	1.50	1.30

Representative Transect Characteristics

Transect Number 2	Depth (m)	Velocity (m/s) .8d	.6d	.2d	Substrate (%)	Cover (%)
1/3 width	1.50	1.425	1.846[a]	2.266	MG5, LG20, SC25, LC50	F30, J1, A5
2/3 width	0.90	1.419	1.561	1.703	MG5, LG20, SC50, LC25	F20, J5, A2

Habitat Characteristics at Fish Capture Locations

Point Number	Depth (m)	Velocity (m/s) .8d	.6d	.2d	Substrate (%)	Cover (%)
1	0.78	0.208	0.296[a]	0.384	S170, LG5, SC5, LC20	F10, J5, A2
2	0.94	0.538	0.695[a]	0.852	MG5, LG20, SC50, LC25	F20, J5, A2

[a] Calculated as the mean of measurements at 0.8 and 0.2 of depth.

HABITAT LOCATION RECORD

Habitat Location Number: 6
Category: Pool
Location: Seg 6 - 312.4 km
Species Present: mountain whitefish-A,J

Mean Length (m): 28.0
Mean Width (m): 18.3
Area (m^2): 512.4
Maximum Depth (m): 1.50
Mean Depth: (m): 1.21
Canopy Cover (%): 0
Substrate Compaction: Loose

Transect Characteristics

Transect Number	Depth (m) 1/3 width	2/3 width
1	1.25	1.20
2	1.10	1.36
3	1.00	1.10

Representative Transect Characteristics

Transect Number 2	Depth (m)	Velocity (m/s) .8d	.6d	.2d	Substrate (%)	Cover (%)
1/3 width	1.10	0.039	0.041[a]	0.043	Silt 100	0
2/3 width	1.36	0.043	0.043[a]	0.043	Silt 100	0

Habitat Characteristics at Fish Capture Locations

Point Number	Depth (m)	Velocity (m/s) .8d	.6d	.2d	Substrate (%)	Cover (%)
1	1.10	0.039	0.041[a]	0.043	Silt 100	0
2	1.36	0.043	0.043[a]	0.043	Silt 100	0

[a] Calculated as the mean of measurements of 0.8 and 0.2 of depth.

HABITAT LOCATION RECORD

Habitat Location Number:	7	Mean Length (m):	133.0
Category:	Riffle	Mean Width (m):	53.3
Location:	Seg 5 - 309.5 km	Area (m^2):	7088.9
Species Present:	mountain whitefish-A,J	Maximum Depth (m):	1.75
	rainbow trout-A	Mean Depth: (m):	1.11
		Canopy Cover (%):	0
		Substrate Compaction:	Loose

Transect Characteristics

Transect Number	Depth (m) 1/3 width	2/3 width
1	1.50	1.10
2	1.10	0.68
3	0.60	1.02

Representative Transect Characteristics

Transect Number 2	Depth (m)	Velocity (m/s) .8d	.6d	.2d	Substrate (%)	Cover (%)
1/3 width	1.10	0.972	1.502[a]	2.031	Sa30, SG50, MG18, LG2	F1
2/3 width	0.68		1.293		MG10, LG30, SC20, LC20, SB20	F30, J15, A10

Habitat Characteristics at Fish Capture Locations

Point Number	Depth (m)	Velocity (m/s) .8d	.6d	.2d	Substrate (%)	Cover (%)
1	0.79	0.449	0.566[a]	0.683	Sa50, SG30, MG18, LG2	F1
2	1.02	0.711	0.889[a]	1.067	MG5, LG20, SC30, LC45	F20, J5, A2
3	1.02	0.192	0.269[a]	0.346	LG10, SC20, LC60, SB10	F40, J20, A10

a Calculated as the mean of measurements at 0.8 and 0.2 of depth.

HABITAT LOCATION RECORD

Habitat Location Number:	8	Mean Length (m):	171.0
Category:	Run	Mean Width (m):	67.7
Location:	Seg 5 - 309.4 km	Area (m^2):	11576.7
Species Present:	mountain whitefish-A,J	Maximum Depth (m):	1.75
	rainbow trout-A	Mean Depth: (m):	1.08
		Canopy Cover (%):	0
		Substrate Compaction:	Compact

Transect Characteristics

Transect Number	Depth (m) 1/3 width	2/3 width
1	0.85	1.25
2	0.64	1.00
3	0.70	1.35

Representative Transect Characteristics

Transect Number 2	Depth (m)	Velocity (m/s) .8d	.6d	.2d	Substrate (%)	Cover (%)
1/3 width	0.64		0.928		SB20, LB30, Bed 50	F60, J40, A20
2/3 width	1.00	0.758	1.032[a]	1.306	LG40, SC50, LC10	F15, J15, A10

Habitat Characteristics at Fish Capture Locations

Point Number	Depth (m)	Velocity (m/s) .8d	.6d	.2d	Substrate (%)	Cover (%)
1	1.02	0.928	1.095[a]	1.263	SB20, LB30, Bed 50	F60, J40, A20
2	1.00	0.758	0.785	0.812	LG10, SC10, Bed 80	F20, J10, A5

[a] Calculated as the mean of measurements at 0.8 and 0.2 of depth.

HABITAT LOCATION RECORD

Habitat Location Number: 9
Category: Run
Location: Seg 5 - 308.8 km
Species Present: mountain whitefish-A,J

Mean Length (m): 200.0
Mean Width (m): 60.0
Area (m^2): 1200.0
Maximum Depth (m): 1.50
Mean Depth: (m): 0.98
Canopy Cover (%): 0
Substrate Compaction: Loose

Transect Characteristics

Transect Number	Depth (m) 1/3 width	2/3 width
1	0.45	1.50
2	0.72	0.86
3	0.85	1.00

Representative Transect Characteristics

Transect Number 2	Depth (m)	Velocity (m/s) .8d	.6d	.2d	Substrate (%)	Cover (%)
1/3 width	0.72		1.235		SG10, MG50, LG40	F1
2/3 width	0.86	1.133	1.451[a]	1.77	SG5, MG30, LG45, SC15, LC5	F20, J10, A5

Habitat Characteristics at Fish Capture Locations

Point Number	Depth (m)	Velocity (m/s) .8d	.6d	.2d	Substrate (%)	Cover (%)
1	0.60		0.398		MG20, LG60, SC15, LC5	F10, J5, A2
2	0.50		0.758		SG10, MG50, LG40	F1
3	0.60		0.972		MG2, LG8, SC30, LC60	F30, J20, A20

a Calculated as the mean of measurements at 0.8 and 0.2 of depth.

HABITAT LOCATION RECORD

Habitat Location Number: 10
Category: Pool
Location: Seg 5 - 308.7 km
Species Present: mountain whitefish-A,J

Mean Length (m): 76.0
Mean Width (m): 60.0
Area (m^2): 4560.0
Maximum Depth (m): 5.0
Mean Depth: (m): 2.68
Canopy Cover (%): 0
Substrate Compaction: Compact

Transect Characteristics

Transect Number	Depth (m) 1/3 width	2/3 width
1	1.75	3.50
2	1.50	3.50
3	1.50	2.00

Representative Transect Characteristics

Transect Number 2	Depth (m)	Velocity (m/s) .8d	.6d	.2d	Substrate (%)	Cover (%)
1/3 width	1.5	0.568	0.568	0.568	S190, SB10	F5, J2, A2
2/3 width	3.5	0.182	0.202[a]	0.222	LB100	F30, J10, A10

Habitat Characteristics at Fish Capture Locations

Point Number	Depth (m)	Velocity (m/s) .8d	.6d	.2d	Substrate (%)	Cover (%)
1	1.50	0.245	0.147[a]	0.049	S:80, SB20	F10, J5, A5
2	0.95	0.469	0.437[a]	0.406	Silt 100	0
	1.225		0.292			

a Calculated as the mean of measurements at 0.8 and 0.2 of depth.

HABITAT LOCATION RECORD

Habitat Location Number:	11	Mean Length (m):	247.5
Category:	Run	Mean Width (m):	56.0
Location:	Seg 5 - 301.5 km (south channel)	Area (m^2):	13860.0
Species Present:	mountain whitefish-A,J	Maximum Depth (m):	1.20
	rainbow trout-J	Mean Depth: (m):	0.80
		Canopy Cover (%):	0
		Substrate Compaction:	Loose

Transect Characteristics

Transect Number	Depth (m) 1/3 width	2/3 width
1	1.00	0.90
2	0.87	0.60
3	0.55	0.50

Representative Transect Characteristics

Transect Number 2	Depth (m)	Velocity (m/s) .8d	.6d	.2d	Substrate (%)	Cover (%)
1/3 width	0.87	0.622	0.737[a]	0.852	MG5, LG55, SC30, LC10	F20, J10, A5
2/3 width	0.60		0.651		MG5, LG55, SC30, LC10	F20, J10, A5

Habitat Characteristics at Fish Capture Locations

Point Number	Depth (m)	Velocity (m/s) .8d	.6d	.2d	Substrate (%)	Cover (%)
1	0.86	0.204	0.275[a]	0.346	SG5, MG10, LG20, SC40, LC20, SB5	F15, J5, A2
2	0.57		0.515		MG5, LG55, SC30, LC10	F20, J10, A5

[a] Calculated as the mean of measurements at 0.8 and 0.2 depth.

HABITAT LOCATION RECORD

Habitat Location Number:	12	Mean Length (m):	105.0
Category:	Run	Mean Width (m):	46.7
Location:	Seg 5 - 301.4 km (north channel)	Area (m^2):	4903.5
Species Present:	mountain whitefish-A,J	Maximum Depth (m):	1.10
		Mean Depth: (m):	0.81
		Canopy Cover (%):	0
		Substrate Compaction:	Loose

Transect Characteristics

Transect Number	Depth (m) 1/3 width	2/3 width
1	0.90	1.00
2	0.64	0.80
3	0.55	0.65

Representative Transect Characteristics

Transect Number 2	Depth (m)	Velocity (m/s) .8d	.6d	.2d	Substrate (%)	Cover (%)
1/3 width	0.64		0.928		MG20, LG30, SC40, LC10	F5
2/3 width	0.80	0.928	1.081[a]	1.235	LG20, SC60, LC20	F20, J10, A2

Habitat Characteristics at Fish Capture Locations

Point Number	Depth (m)	Velocity (m/s) .8d	.6d	.2d	Substrate (%)	Cover (%)
1	0.62		0.515		SG5, MG10, LG30, SC30, LC25	F20, J5, A2
2	0.49		0.812		MG10, LG50, SC30, LC10	F15, J5, A2

[a] Calculated as the mean of measurements at 0.8 and 0.2 depth.

HABITAT LOCATION RECORD

Habitat Location Number:	13	Mean Length (m):	125.0
Category:	Pool	Mean Width (m):	31.7
Location:	Seg 5 - 301.6 km (north channel)	Area (m^2):	3962.5
Species Present:	mountain whitefish-A,J	Maximum Depth (m):	3.5
	rainbow trout-A	Mean Depth: (m):	2.26
		Canopy Cover (%):	1.0
		Substrate Compaction:	Compact

Transect Characteristics

Transect Number	Depth (m) 1/3 width	2/3 width
1	2.50	2.00
2	2.15	2.20
3	1.50	2.00

Representative Transect Characteristics

Transect Number 2	Depth (m)	Velocity (m/s) .8d	.6d	.2d	Substrate (%)	Cover (%)
1/3 width	2.15	0.064	0.107[a]	0.151	Silt 100	0
2/3 width	2.20	0.908	1.103[a]	1.298	Silt 100	0

Habitat Characteristics at Fish Capture Locations

Point Number	Depth (m)	Velocity (m/s) .8d	.6d	.2d	Substrate (%)	Cover (%)
1	2.18	0.248	0.196[a]	0.145	Silt 100	0
2	2.15	0.064	0.107[a]	0.151	Silt 100	0

[a] Calculated as the mean of measurements at 0.8 and 0.2 depth.

HABITAT LOCATION RECORD

Habitat Location Number: 14
Category: Run
Location: Seg 5 - 304.7 km
Species Present: mountain whitefish-A,J

Mean Length (m): 77.0
Mean Width (m): 63.0
Area (m^2): 4851.0
Maximum Depth (m): 1.75
Mean Depth: (m): 1.12
Canopy Cover (%): 0
Substrate Compaction: Loose

Transect Characteristics

Transect Number	Depth (m) 1/3 width	2/3 width
1	0.75	0.80
2	1.09	0.82
3	1.10	1.52

Representative Transect Characteristics

Transect Number 2	Depth (m)	Velocity (m/s) .8d	.6d	.2d	Substrate (%)	Cover (%)
1/3 width	1.09	0.683[a]	0.795[a]	0.908	LG20, SC50, LC30	F20, J5, A2
2/3 width	0.82	0.515[a]	0.663[a]	0.812	LG10, SC60, LC30	F30, J10, A5

Habitat Characteristics at Fish Capture Locations

Point Number	Depth (m)	Velocity (m/s) .8d	.6d	.2d	Substrate (%)	Cover (%)
1	1.09	0.683	0.795[a]	0.908	LG20, SC50, LC30	F20, J5, A2
2	0.82	0.515	0.663[a]	0.812	LG10, SC60, LC30	F30, J10, A5
3	0.93	0.852	1.017[a]	1.182	LG10, SC30, LC50, SB10	F40, J30, A15

[a] Calculated as the mean of measurements at 0.8 and 0.2 depth.

HABITAT LOCATION RECORD

Habitat Location Number:	15	Mean Length (m):	42.0
Category:	Pool	Mean Width (m):	19.0
Location:	Seg 5 - 307.4 km	Area (m^2):	798.0
Species Present:	mountain whitefish-A,J	Maximum Depth (m):	1.40
	rainbow trout-A	Mean Depth: (m):	0.97
		Canopy Cover (%):	0
		Substrate Compaction:	Compact

Transect Characteristics

Transect Number	Depth (m) 1/3 width	2/3 width
1	1.15	1.40
2	1.04	0.98
3	0.54	0.30

Representative Transect Characteristics

Transect Number 2	Depth (m)	Velocity (m/s) .8d	.6d	.2d	Substrate (%)	Cover (%)
1/3 width	1.04	0.043	0.052[a]	0.061	SG20, MG30, LG30, SC15, LC5	F10, J2
2/3 width	0.98	0.017	0.020[a]	0.023	SG40, MG20, LG20, SC20	F5

Habitat Characteristics at Fish Capture Locations

Point Number	Depth (m)	Velocity (m/s) .8d	.6d	.2d	Substrate (%)	Cover (%)
1	1.04	0.043	0.052[a]	0.061	SG20, MG30, LG30, SC15, LC5	F10, J2
2	0.98	0.017	0.020[a]	0.023	SG40, MG20, LG20, SC20	F5
3	1.40	0.000	0.000[a]	0.000	S140, LG10, SC30, LC20	F10, J5, A2

[a] Calculated as the mean of measurements at 0.8 and 0.2 depth.

HABITAT LOCATION RECORD

Habitat Location Number: 32
Category: Riffle
Location: Seg 5 - 285.3 km
Species Present: mountain whitefish-A,J

Mean Length (m): 132.0
Mean Width (m): 62.0
Area (m^2): 8184.0
Maximum Depth (m): 1.10
Mean Depth: (m): 0.79
Canopy Cover (%): 0
Substrate Compaction: Loose

Transect Characteristics

Transect Number	Depth (m) 1/3 width	2/3 width
1	0.80	1.00
2	0.66	0.84
3	0.55	0.60

Representative Transect Characteristics

Transect Number 2	Depth (m)	Velocity (m/s) .8d	.6d	.2d	Substrate (%)	Cover (%)
1/3 width	0.66		1.067		SG10, MG10, LG40, SC30, LC10	F20, J10, A2
2/3 width	0.84	0.758	1.116[a]	1.475	LG10, SC10, LC50, SB30	F60, J30, A10

Habitat Characteristics at Fish Capture Locations

Point Number	Depth (m)	Velocity (m/s) .8d	.6d	.2d	Substrate (%)	Cover (%)
1	0.54		1.213		LG10, SC20, LC70	F30, J20, A10
2	0.58		0.651		MG10, LG60, SC10, LC20	F20, J10, A5

[a] Calculated as the mean of measurements at 0.8 and 0.2 depth.

HABITAT LOCATION RECORD

Habitat Location Number:	34	Mean Length (m):	186.0
Category:	Run	Mean Width (m):	60.0
Location:	Seg 5 - 282.0 km	Area (m^2):	11160.0
Species Present:	mountain whitefish-A,J	Maximum Depth (m):	2.10
	rainbow trout-A	Mean Depth: (m):	1.18
		Canopy Cover (%):	0
		Substrate Compaction:	Loose

Transect Characteristics

Transect Number	Depth (m) 1/3 width	2/3 width
1	0.75	1.25
2	0.70	1.32
3	0.60	1.55

Representative Transect Characteristics

Transect Number 2	Depth (m)	Velocity (m/s) .8d	.6d	.2d	Substrate (%)	Cover (%)
1/3 width	0.70		0.370		SG30, MG40, LG30	F5
2/3 width	1.32	0.593	0.645[a]	0.697	S15, SG15, MG30, LG35, SC5, LC10	F20, J10, A5

Habitat Characteristics at Fish Capture Locations

Point Number	Depth (m)	Velocity (m/s) .8d	.6d	.2d	Substrate (%)	Cover (%)
1	1.08	0.812	0.984[a]	1.157	MG10, LG20, SC30, LC30, SB10	F20, J15, A15
2	1.32	0.852	1.030[a]	1.208	S110, MG20, LG40, SC10, LC20	F20, J15, A10

[a] Calculated as the mean of measurements at 0.8 and 0.2 depth.

HABITAT LOCATION RECORD

Habitat Location Number:	36	Mean Length (m):	171.0
Category:	Run	Mean Width (m):	80.0
Location:	Seg 4 - 261.5 km	Area (m^2):	13 680.0
Species Present:	mountain whitefish-A,J	Maximum Depth (m):	0.90
		Mean Depth: (m):	0.64
		Canopy Cover (%):	1.0
		Substrate Compaction:	Loose

Transect Characteristics

Transect Number	Depth (m) 1/3 width	2/3 width
1	0.74	0.41
2	0.41	0.73
3	0.80	0.50

Representative Transect Characteristics

Transect Number 2	Depth (m)	Velocity (m/s) .8d	.6d	.2d	Substrate (%)	Cover (%)
1/3 width	0.41		0.939		SG5, MG20, LG10, SC10, LC55	F30, J15, A5
2/3 width	0.73		0.793		LG10, SC20, LC50, SB20	F30, J20, A5

Habitat Characteristics at Fish Capture Locations

Point Number	Depth (m)	Velocity (m/s) .8d	.6d	.2d	Substrate (%)	Cover (%)
1	0.52		0.889		LG10, SC20, LC50, SB20	F30, J20, A5
2	0.47		1.182		SG5, MG20, LG10, SC10, LC55	F30, J15, A5

HABITAT LOCATION RECORD

Habitat Location Number: 39
Category: Run
Location: Seg 4 - 254.3 km
Species Present: mountain whitefish-A,J

Mean Length (m): 492.0
Mean Width (m): 75.0
Area (m^2): 36 900.0
Maximum Depth (m): 1.30
Mean Depth: (m): 0.87
Canopy Cover (%): 0.87
Substrate Compaction: Compact

Transect Characteristics

Transect Number	Depth (m) 1/3 width	2/3 width
1	0.30	0.65
2	1.02	1.14
3	0.70	0.95

Representative Transect Characteristics

Transect Number 2	Depth (m)	Velocity (m/s) .8d	.6d	.2d	Substrate (%)	Cover (%)
1/3 width	1.02	0.683	0.795[a]	0.908	SG10, MG50, LG30, SC10	F30, J15, A10
2/3 width	1.14	0.651	0.835[a]	1.020	S110, MG2, LG10, SC15, LC30, SB33	F45, J25, A20

Habitat Characteristics at Fish Capture Locations

Point Number	Depth (m)	Velocity (m/s) .8d	.6d	.2d	Substrate (%)	Cover (%)
1	1.30	0.742	0.881[a]	1.020	S110, LG10, SC20, LC30, SB30	F50, J30, A20
2	0.91	0.583	0.736[a]	0.889	S110, MG5, LG10, SC10, LC30, SB35	F40, J20, A15

[a] Calculated as the mean of measurements of 0.8 and 0.2 of depth.

HABITAT LOCATION RECORD

Habitat Location Number: 40
Category: Run
Location: Seg 4 - 251.5 km
Species Present: mountain whitefish-A,J

Mean Length (m): 194.0
Mean Width (m): 27.0
Area (m^2): 5 238.0
Maximum Depth (m): 1.70
Mean Depth: (m): 1.23
Canopy Cover (%): 0
Substrate Compaction: Compact

Transect Characteristics

Transect Number	Depth (m) 1/3 width	2/3 width
1	1.00	0.65
2	1.18	0.90
3	1.70	1.50

Representative Transect Characteristics

Transect Number 2	Depth (m)	Velocity (m/s) .8d	.6d	.2d	Substrate (%)	Cover (%)
1/3 width	1.18	1.067	1.304[a]	1.541	LG7, SC25, LC43, SB25	F50, J35, A25
2/3 width	0.90	1.110	1.217[a]	1.325	LG7, SC25, LC43, SB25	F50, J35, A25

Habitat Characteristics at Fish Capture Locations

Point Number	Depth (m)	Velocity (m/s) .8d	.6d	.2d	Substrate (%)	Cover (%)
1	0.90	1.110	1.186[a]	1.263	LG5, SC30, LC35, SB30	F40, J30, A15
2	1.36	0.812	0.972[a]	1.133	LG10, SC20, LC50, SB20	F60, J40, A30

[a] Calculated as the mean of measurements of 0.8 and 0.2 of depth.

HABITAT LOCATION RECORD

Habitat Location Number: 41
Category: Riffle
Location: Seg 4 - 251.3 km
Species Present: mountain whitefish-A,J

Mean Length (m): 243.0
Mean Width (m): 47.0
Area (m^2): 11,421.0
Maximum Depth (m): 1.00
Mean Depth: (m): 0.75
Canopy Cover (%): 0
Substrate Compaction: Compact

Transect Characteristics

Transect Number	Depth (m) 1/3 width	2/3 width
1	1.00	0.65
2	0.92	0.63
3	0.50	0.60

Representative Transect Characteristics

Transect Number 2	Depth (m)	Velocity (m/s) .8d	.6d	.2d	Substrate (%)	Cover (%)
1/3 width	0.92	0.950	1.282[a]	1.614	LG15, SC20, LC65	F40, J20, A10
2/3 width	0.63		1.067		LG15, SC20, LC65	F40, J20, A10

Habitat Characteristics at Fish Capture Locations

Point Number	Depth (m)	Velocity (m/s) .8d	.6d	.2d	Substrate (%)	Cover (%)
1	0.74		1.325		LG5, SC10, LC50, SB35	F60, J50, A30
2	0.55		0.928		LG15, SC20, LC65	F40, J20, A10

[a] Calculated as the mean of measurements at 0.8 and 0.2 of depth.

HABITAT LOCATION RECORD

Habitat Location Number: 47
Category: Run
Location: Seg 4 - 239.2 km
Species Present: mountain whitefish-A,J

Mean Length (m): 326.0
Mean Width (m): 72.0
Area (m^2): 23 472.0
Maximum Depth (m): 1.20
Mean Depth: (m): 0.89
Canopy Cover (%): 0
Substrate Compaction: Loose

Transect Characteristics

Transect Number	Depth (m) 1/3 width	2/3 width
1	1.10	0.70
2	0.86	0.82
3	0.70	0.90

Representative Transect Characteristics

Transect Number 2	Depth (m)	Velocity (m/s) .8d	.6d	.2d	Substrate (%)	Cover (%)
1/3 width	0.86	0.793	0.940[a]	1.088	LG5, SC25, LC50, SB20	F65, J35, A25
2/3 width	0.82	0.758	0.923[a]	1.088	LG5, SC25, LC50, SB20	F65, J35, A25

Habitat Characteristics at Fish Capture Locations

Point Number	Depth (m)	Velocity (m/s) .8d	.6d	.2d	Substrate (%)	Cover (%)
1	0.67		1.067		LG5, SC20, LC60, SB15	F70, J40, A25
2	0.82	0.651	0.848[a]	1.046	LG5, SC30, LC40, SB25	F60, J30, A20

[a] Calculated as the mean of measurements at 0.8 and 0.2 of depth.

HABITAT LOCATION RECORD

Habitat Location Number: 48
Category: Riffle
Location: Seg 4 - 236.2 km
Species Present: mountain whitefish-A,J

Mean Length (m): 166.
Mean Width (m): 67.0
Area (m^2): 11 122.0
Maximum Depth (m): 1.00
Mean Depth: (m): 0.71
Canopy Cover (%): 0
Substrate Compaction: Loose

Transect Characteristics

Transect Number	Depth (m) 1/3 width	2/3 width
1	0.50	0.70
2	0.66	0.82
3	0.60	0.70

Representative Transect Characteristics

Transect Number 2	Depth (m)	Velocity (m/s) .8d	.6d	.2d	Substrate (%)	Cover (%)
1/3 width	0.66		0.996		SG10, MG30, LG50, SC10	F10
2/3 width	0.82	0.775	0.897[a]	1.020	SG5, MG20, LG60, SC15	F30, J10, A5

Habitat Characteristics at Fish Capture Locations

Point Number	Depth (m)	Velocity (m/s) .8d	.6d	.2d	Substrate (%)	Cover (%)
1	0.53		0.812		SG5, MG10, LG50, SC30, LC5	F20, J5
2	0.66		0.996		SG10, MG30, LG50, SC10	F10
3	0.82	0.775	0.987[a]	1.020	SG5, MG20, LG60, SC15	F30, J10, A5

a Calculated as the mean of measurements at 0.8 and 0.2 of depth.

HABITAT LOCATION RECORD

Habitat Location Number: 49
Category: Run
Location: Seg 4 - 235.0 km
Species Present: mountain whitefish-A,J

Mean Length (m): 979.0
Mean Width (m): 90.0
Area (m^2): 88 110.0
Maximum Depth (m): 1.30
Mean Depth: (m): 0.73
Canopy Cover (%): 0
Substrate Compaction: Compact

Transect Characteristics

Transect Number	Depth (m) 1/3 width	2/3 width
1	0.55	0.65
2	0.88	0.76
3	0.35	0.60

Representative Transect Characteristics

Transect Number 2	Depth (m)	Velocity (m/s) .8d	.6d	.2d	Substrate (%)	Cover (%)
1/3 width	0.88	0.812	0.961[a]	1.110	LG30, SC30, LC30, SB10	F30, J25, A20
2/3 width	0.76	0.711	0.910[a]	1.110	MG20, LG40, SC40	F15, J10, A5

Habitat Characteristics at Fish Capture Locations

Point Number	Depth (m)	Velocity (m/s) .8d	.6d	.2d	Substrate (%)	Cover (%)
1	1.04	0.852	1.088[a]	1.325	LG10, SC30, LC40, SB20	F50, J40, A20
2	0.88	0.812	0.961[a]	1.110	LG30, SC30, LC30, SB10	F30, J25, A20
3	1.03	0.758	0.889[a]	1.020	LG5, SC30, LC40, SB25	F70, J50, A30

[a] Calculated as the mean of measurements at 0.8 and 0.2 of depth.

HABITAT LOCATION RECORD

Habitat Location Number: 50
Category: Riffle
Location: Seg 4 - 229.8 km
Species Present: mountain whitefish-A,J

Mean Length (m): 181.0
Mean Width (m): 55.0
Area (m^2): 9 955.0
Maximum Depth (m): 2.00
Mean Depth: (m): 1.08
Canopy Cover (%): 0
Substrate Compaction: Loose

Transect Characteristics

Transect Number	Depth (m) 1/3 width	2/3 width
1	0.80	0.55
2	0.80	0.84
3	1.30	1.30

Representative Transect Characteristics

Number 2	Depth (m)	Velocity (m/s) .8d	.6d	.2d	Substrate (%)	Cover (%)
1/3 width	0.80	1.182	1.438[a]	1.694	MG15, LG30, SC30, LC25	F60, J30, A10
2/3 width	0.84	0.667	0.768[a]	0.870	MG15, LG30, SC30, LC25	F60, J30, A10

Habitat Characteristics at Fish Capture Locations

Point Number	Depth (m)	Velocity (m/s) .8d	.6d	.2d	Substrate (%)	Cover (%)
1	1.26	0.928	1.068[a]	1.208	LG40, SC40, LC20	F70, J30, A10
2	0.80	1.182	1.438[a]	1.694	MG15, LG30, SC30, LC25	F60, J30, A10

[a] Calculated as the mean of measurements at 0.8 and 0.2 of depth.

HABITAT LOCATION RECORD

Habitat Location Number: 51
Category: Run
Location: Seg 4 - 228.0 km
Species Present: mountain whitefish-A,J

Mean Length (m): 522.0
Mean Width (m): 53.0
Area (m^2): 27 660.0
Maximum Depth (m): 1.30
Mean Depth: (m): 0.81
Canopy Cover (%): 0
Substrate Compaction: Compact

Transect Characteristics

Transect Number	Depth (m) 1/3 width	2/3 width
1	0.55	0.65
2	0.46	0.88
3	0.80	1.00

Representative Transect Characteristics

Transect Number 2	Depth (m)	Velocity (m/s) .8d	.6d	.2d	Substrate (%)	Cover (%)
1/3 width	0.46		0.908		SG20, MG20, LG50, SC10	F20, J5, A2
2/3 width	0.88	0.775	0.901[a]	1.027	SG20, MG20, LG50, SC10	F20, J5, A2

Habitat Characteristics at Fish Capture Locations

Point Number	Depth (m)	Velocity (m/s) .8d	.6d	.2d	Substrate (%)	Cover (%)
1	0.56		1.325		MG10, LG30, SC40, LC20	F30, J5, A2
2	0.88	0.775	0.901[a]	1.027	SG20, MG20, LG50, SC10	F20, J5, A2

[a] Calculated as the mean of measurements of 0.8 and 0.2 of depth.

HABITAT LOCATION RECORD

Habitat Location Number: 52
Category: Riffle
Location: Seg 3 - 212.0 km
Species Present: mountain whitefish-A,J

Mean Length (m): 508.0
Mean Width (m): 62.0
Area (m^2): 31496.0
Maximum Depth (m): 1.20
Mean Depth: (m): 0.77
Canopy Cover (%): 0
Substrate Compaction: Loose

Transect Characteristics

Transect Number	Depth (m) 1/3 width	2/3 width
1	1.05	0.75
2	0.62	0.76
3	0.60	0.40

Representative Transect Characteristics

Transect Number 2	Depth (m)	Velocity (m/s) .8d	.6d	.2d	Substrate (%)	Cover (%)
1/3 width	0.62		1.02		MG10, LG40, SC40, LC10	F30, J10, A5
2/3 width	0.76	0.852	0.959[a]	1.067	MG10, LG40, SC40, LC10	F30, J10, A5

Habitat Characteristics at Fish Capture Locations

Point Number	Depth (m)	Velocity (m/s) .8d	.6d	.2d	Substrate (%)	Cover (%)
1	0.76	0.852	0.959[a]	1.067	MG10, LG40, SC40, LC10	F30, J10, A5
2	0.86	1.263	1.338[a]	1.414	LG5, SC20, LC10, SB50, LB15	F60, J50, A35

[a] Calculated as the mean of measurements at 0.8 and 0.2 depth.

HABITAT LOCATION RECORD

Habitat Location Number: 53
Category: Riffle
Location: Seg 3 - 209.5 km
Species Present: mountain whitefish-A,J

Mean Length (m): 149.0
Mean Width (m): 97.0
Area (m^2): 14 453.0
Maximum Depth (m): 1.10
Mean Depth: (m): 0.63
Canopy Cover (%): 0
Substrate Compaction: Compact

Transect Characteristics

Transect Number	Depth (m) 1/3 width	2/3 width
1	0.40	0.70
2	0.48	0.80
3	0.75	0.65

Representative Transect Characteristics

Transect Number 2	Depth (m)	Velocity (m/s) .8d	.6d	.2d	Substrate (%)	Cover (%)
1/3 width	0.48		0.793		SG10, MG30, LG50, SC10	F10
2/3 width	0.80	0.950	1.106[a]	1.263	LG10, SC20, LC10, SB30, LB30	F60, J50, A40

Habitat Characteristics at Fish Capture Locations

Point Number	Depth (m)	Velocity (m/s) .8d	.6d	.2d	Substrate (%)	Cover (%)
1	0.90	0.928	1.068[a]	1.208	SC10, LC10, LB20, Bed 60	F40, J30, A25
2	0.80	0.950	1.106[a]	1.263	LG10, SC20, LC10, SB30, LB30	F60, J50, A40

[a] Calculated as the mean of measurements at 0.8 and 0.2 depth.

HABITAT LOCATION RECORD

Habitat Location Number: 55
Category: Riffle
Location: Seg 3 - 202.0 km
Species Present: mountain whitefish-A,J

Mean Length (m): 188.0
Mean Width (m): 55.0
Area (m^2): 10 340.0
Maximum Depth (m): 0.80
Mean Depth: (m): 0.53
Canopy Cover (%): 0
Substrate Compaction: Compact

Transect Characteristics

Transect Number	Depth (m) 1/3 width	2/3 width
1	0.70	0.40
2	0.64	0.53
3	0.40	0.50

Representative Transect Characteristics

Transect Number 2	Depth (m)	Velocity (m/s) .8d	.6d	.2d	Substrate (%)	Cover (%)
1/3 width	0.64		0.742		LG5, SC30, LC65	F40, J20, A5
2/3 width	0.53		0.667		LG5, SC30, LC65	F30, J20, A5

Habitat Characteristics at Fish Capture Locations

Point Number	Depth (m)	Velocity (m/s) .8d	.6d	.2d	Substrate (%)	Cover (%)
1	0.64		0.742		LG5, SC30, LC65	F40, J20, A5
2	0.46		1.182		MG5, LG40, SC40, LC15	F20, J45, A2